

29-H53
1:1919-1920
c.2

STATE OF NEVADA

BIENNIAL REPORT

OF THE

DEPARTMENT OF HIGHWAYS

1919=1920



CARSON CITY, NEVADA

STATE PRINTING OFFICE, : : : JOE FARNSWORTH, SUPERINTENDENT

1921

TO THE PUBLIC OF NEVADA

Greetings:

In the attached report we have endeavored to place before you in a fair and impartial manner the accomplishments of your State Highway Department. To those of you who have assisted us by your friendly help we trust the report will come as a justification of such help and friendship, and to those of you who are our critics we hope it will serve as a foundation of truth for the dissemination of information as to the activities of the Department.

DEPARTMENT OF HIGHWAYS.

TO THE BOARD OF TRUSTEES

(Continued)

In the attached report we have endeavored to show before you in a plain and impartial manner the economic conditions of your State Highway Department. To the end of you will have assisted us by your friendly help we trust the report will come as a justification of such help and understanding to those of you who are not officers we hope it will serve as a foundation of truth for the dissemination of information as to the activities of the Department.

DEPARTMENT OF HIGHWAYS



3 1428 00295 8243

STATE OF NEVADA

BIENNIAL REPORT

OF THE

DEPARTMENT OF HIGHWAYS

1919=1920



CARSON CITY, NEVADA

STATE PRINTING OFFICE : : : JOE FARNSWORTH, SUPERINTENDENT

1921



LETTER OF TRANSMITTAL

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS
CARSON CITY

To the Honorable EMMET D. BOYLE, Governor of the State of Nevada.

DEAR SIR: The undersigned, Directors of the Department of Highways appointed and acting under the provisions of the Nevada State Highway Law, herewith submit their second report, for the biennial period January 1, 1919, to November 30, 1920.

Through this report we have endeavored to set forth briefly the accomplishments of the Department on the construction of the State Highway System.

We wish to take this opportunity to thank you and the other state officers for their hearty cooperation in carrying on the wide activities of the Department, and, through this report, to express our appreciation and commendation of all the employees of the Department, who, through their loyalty and support, have contributed to such measure of success as has been attained.

JAMES M. LEONARD,
Chairman.

W. H. JOHNSTON,
Director.

GEO. A. CAMPBELL,
Director.

JAN
W.
GE
C.
FL

GE
L.
H.
A.
C.
H.
T.
J.

REPORT OF THE DEPARTMENT OF HIGHWAYS

INTRODUCTORY

Conditions existing through the biennial period of 1917-1919, with which every one is familiar, were such as to prohibit the construction of highways, and, if no other reason were available, the attitude of the Government during that war period was such as to prohibit the doing of the work. During that period, however, considerable preparatory work was done, which was of inestimable value in undertaking the construction work of the second biennial period of this department.

At the close of that biennial period the war had terminated and it appeared as though conditions would rapidly return to normal. We, in common with all of the other state highway departments of the country, looked forward to the biennial period of 1919-1920 as one in which we could do a great amount of construction work without being hampered by the difficulties which had previously existed. We believed that we could purchase materials and equipment at favorable prices, and that the labor situation would be clarified, even to the point that we might be required to partly care for an army of unemployed.

While we are glad that such a chaotic condition did not exist, conditions were far from what had been anticipated, in that prices did not recede, nor was there an overabundance of labor—in fact, not enough labor has been obtainable to properly carry on our work. So acute was the material and equipment situation and labor conditions that to a very large extent our program has been gaged thereby, and we have been forced to seriously consider at different times the advisability of ceasing the attempt to do construction work at all.

Facing, on the one hand, the insistent demand for highway construction, and, on the other, high prices and difficulties of every nature, we have carefully weighed each project before proceeding. In some cases our opinion has been to delay the work until a more opportune time; in others it was such as to forbid our going ahead at all, and in still others where the difficulties were sufficiently well removed and the improvement so obviously justified we felt warranted in proceeding. The progress of work in other States, particularly those of the West, was watched with considerable interest, and compared with the progress of those States no apology need be made by this department for its accomplishments during this biennial period.

The department has caused to be completed in this biennial period 144.08 miles of road and 6 bridges. This should not be taken to represent the results of the activities of the department, for the reason that while this report is being written there are eight contracts under way involving the additional improvement of 39.55 miles of roadway and 2 bridges. Many things preparatory to an enlarged program have been done, such as the construction of the Lahontan plant, the securing of an equipment organization with equipment, and the removing of certain restrictions of the federal requirements which will in the future permit the more rapid prosecution of work.

The multiplicity of difficulties which have hampered us in our work of the past should not be present in the future. The recent lowering of

prices and the apparent better labor conditions foretell for us an era in which work can be carried on with more rapidity, in a more satisfactory manner, and at a considerably lower cost. When such a condition comes about, it will become apparent to the people of this State that it was well no more construction was completed or undertaken during this last period than has been the case.

This report has been written with the idea of presenting in a readable manner all of the activities of the department, and it is believed that in the various following chapters those matters of interest have been so presented that a comprehensive idea of the endeavors, difficulties, and results encountered and attained by this organization can be had by any one reading the report.

Full acknowledgment should be made of the high sense of loyalty, the perseverance, and the service of the various members of the highway organization, without whose full spirit of cooperation we would not have been able to proceed successfully. This organization was entirely built up during a period when to obtain men required for our different tasks was indeed difficult, and when every other department throughout the country was bidding for their services. Discouragements such as have attended the activities of this department always have a tendency to disrupt any organization, but ours has survived this period to the extent that we are facing the future confident of our ability to carry out any program.

Acknowledgment is also made to the Bureau of Public Roads, and especially to Mr. B. J. Finch, District Engineer at Ogden, for the many ways in which they have greatly assisted this department. There have been many controversies between the bureau and this department, but they have always been carried on in an amicable manner and disposed of in a way that has left a most excellent feeling between the two organizations.

FEDERAL AID ROAD ACT

The original Federal Aid Road Act was passed by the Sixty-fourth Congress, and was signed by the President on January 11, 1916. It was amended by the Sixty-fifth Congress, and signed by the President on February 28, 1919.

Under the original Act there was made available to this State a total sum of money aggregating \$962,684.21 and under the amended Act of 1919 an additional sum of money totaling \$2,564,591.97, making available in all the total sum of \$3,527,276.18.

The purposes of federal participation in road work in the various States were, aside from the financial assistance given to the States: first, the encouragement of the creation of state highway departments and the performance of the work by some centralized authority; second, the improvement of some sort of a comprehensive road system, which would ultimately become the main trunk-line of travel and with which the roads of lesser importance would connect; and, third, the participation in an advisory capacity on the part of the Federal Government and the encouragement of a continuation of road work by the various States after federal aid had ended. Contrary to the belief of many, federal participation in state highway construction is not without some restrictions and many regulations.

Under the conditions of the original Federal Aid Road Act and as later amended, together with the regulations promulgated by the

11. It is provided that, should the State fail to expend within three years any money allotted to it, that the allotment will be withdrawn and the money distributed to the various other States.

12. The State is required to first make the expenditure and then collect it from the Government. The Government participates in the cost of construction as it progresses, but does not pay its share for anything except completed work and materials actually in the roadbed.

13. The Government retains 5% of its share of the cost of each individual project until finally completed and accepted by it as satisfactory.

14. The State is required to forever maintain, in accordance with federal requirements and without financial assistance from the Federal Government, all of the projects which are constructed with federal aid funds.

To those unfamiliar with highway work as it must be carried on in cooperation with the Federal Government, the procedure necessary must seem cumbersome, full of unnecessary details and regulations; but as a matter of fact there is hardly any requirement of the Federal Government, in so far as the procedure is concerned, which could well be avoided and yet carry the work on in an intelligent and businesslike manner. It is true that the requirements impose upon us a heavy duty in the matter of the preparation of plans, the carrying on of the work, and the accounting.

The relations between this department and the bureau have always been amicable. There have been many matters of detail, particularly as to types of roadway, location, and widths of same upon which we could not agree with the opinion of the engineers of the bureau, but in most cases it has been comparatively easy to find an adjustment. Probably the most serious matter which has confronted this department during the biennial period just closing was in the matter of the widths of roadway, the bureau taking the attitude in the early part of the construction season of 1920 that they would not approve road projects of a width less than 24 feet, and to this we could not agree. The matter was taken up by Governor Boyle and Mr. James M. Leonard, Chairman of the Board of Directors of this department. Mr. Leonard's letter relative to this subject follows in full:

The Board of Directors of this department has been watching with alarm the great tendency on the part of your bureau to criticize the width roadway and surfacing proposed in our recent project statements.

This communication is addressed to you partly with the hope that it will explain the reason for our proposals, and partly to induce you to have those of your organization having to do with this criticism come out here and become thoroughly familiar with the conditions with which we are confronted.

No widths of roadway, or of surfacing, have been proposed until the matter has been given very careful thought and consideration by our organization, and in every case these have been approved by your District Engineer, Mr. Finch, in Ogden, a man who is acquainted with our conditions and one who knows our peculiar problems.

The relations between your bureau and our organization have been most amicable, and there is no desire on our part

except to continue our existence in that manner. None of us are actuated by any other motive than to give the public of this State the maximum benefit for the expenditure. Except in the immediate vicinity of our larger towns and cities, the existing roads are single-track desert trails, and for the most part made by the wheel-tracks of the vehicles traversing the territory, and taking the line of least resistance. Rank growths of sagebrush, greasewood, and mesquite mark the limits of this single-track roadway, so that, if one were to view our State from the air, he would distinguish our highways from the rest of the landscape by great strips of barrenness six or seven feet wide. These roads now serve our people passably well, and if a greater width were needed, the need would be recorded on the ground by the traffic itself. Our construction problems are of road surface, drainage, and grades, and not particularly of width. Probably 80% of our existing roads follow the undulations of the ground surface, and the very infrequent passing of vehicles is made without difficulty.

With the installation of drainage structures, however, and the grading made necessary to obtain satisfactory drainage and grades, thought must be given to the passing vehicles when they happen to meet, however infrequent that may be.

Project No. 32, involving the improvement of a section of our State Highway System in Humboldt County, proposed a width of roadway of 20 feet, the maximum which we felt our limited finances would permit, and the most which would really be of service to the traveling public. Exception to this width was taken by your office, and a width of 24 feet proposed; this notwithstanding the fact that the office of the District Engineer had approved the width, and that of the project connecting this one. Number 16 is a graded roadway with a width of 15 feet. It is obvious to us that, if this project were constructed for the full width of roadway suggested by your office, it would be a needless expenditure of money, for the reason that there cannot be, for a long time at least, any use for such a width of roadway, and immediately upon the road becoming used vegetation would grow on each side to such an extent that within a very short period of time there would be visible and usable only a portion of the 24 feet.

Federal Aid Project No. 2, Nye 4-A, is constructed of a roadway width of 15 feet and is now being used; immediately after it was open to traffic, we made an inspection of this project with our engineer, Mr. Cottrell, and came to the conclusion while there and on the ground that to have built the roadway of a greater width would have cost a considerable amount of money and that it was not warranted. Traffic on that project is considerably heavier than it will ever be on Project No. 32, by reason of its proximity to a larger town and it being the main artery of travel from a railroad terminus.

Exception was taken to the width of gravel surface for Nevada Federal Aid Project No. 19 by a letter from your

office to Mr. Finch, dated April 24, in which it was suggested that an additional 2 feet be added in width in order to make the surface 12 feet wide. This 2 feet was not proposed by your bureau in order to change the road from a single-track road to a double-track road, but merely for maintenance purposes. This extra 2-foot width at the contract price of 58 cents per square yard would cost very nearly \$700 per mile for surfacing alone—quite an item in desert-road construction. In the letter above referred to, the statement was made that your bureau is averse to placing a gravel surface of less than 12 feet in width.

All our roads in outlying districts which need be surfaced with gravel we desire to construct of a single-track width, namely 9 and 10 feet, depending upon local gravel conditions. Recent bids on surfacing have brought out the fact that, if we must do any of this work, it will have to be done at very high and exorbitant prices. The contract for Project No. 17 was for a 5-inch gravel surface at 55 cents per square yard; for Project No. 1, 43 cents per square yard, and for Project No. 19, 58 cents per square yard.

While we do not, as a general rule, believe in the policy of cutting down the quality of construction in order to cover more miles of territory, we do know that it is absolutely necessary for us to watch our finances very carefully and build nothing of higher quality than is absolutely necessary. It must always be remembered that with all our state and county tax money, our million-dollar-bond issue, and the bond issues of the various counties, we barely have enough money at this time to meet federal aid that has been made available to this State. Every project which we have must of necessity be a federal aid project and as much of our funds as possible used for the purpose of taking advantage of the federal aid appropriations. It will be difficult, indeed, for us to ask the next Legislature for more money for construction purposes, for the reason that it will be difficult to raise any more money than at present, so that we are confronted with a very difficult problem and made more difficult by reason of the fact that it must be solved during a period of exceptionally high prices. When the maintenance of these various projects requires a drain on our treasury, our problem will be still greater, and especially will this be so if we are required to maintain unimproved desert roads which have not been improved by reason of your requiring us to concentrate our funds on a higher quality of road than we deem necessary for our conditions.

I trust, while this letter may not of itself be a sufficient incentive for your bureau to change its attitude toward the width of the proposed roadways and surfacing, that it will cause you to have a representative from the Washington office come out here and become thoroughly acquainted with our peculiar construction problems and finances.

As a result of the efforts of Governor Boyle and the presentation of the matter by Mr. Leonard's letter, a conference was held in Reno on July 26, at which were present, aside from the members of this department, Dr. Hewes, General Inspector of the Federal Government for the western part of the United States, and Mr. Finch, District Engineer of the Federal Government, who has charge for the Government of the federal road-work in this State. A full and complete discussion took place as a result of which the bureau, through Dr. Hewes, made the statement that the previous attitude as expressed by the Government would be, in part at least, rescinded, and that for roads situated in the outlying districts of the State and in other localities, where the traffic requirements do not require it, the Government would approve projects having a width of roadway of 18 feet or more and a surface width of 10 feet or more. While this met the objections which we had raised, the changed expression came too late in the season to permit of the going ahead with construction work on a few of the projects in the outlying sections of the State.

While the requirements of the Government are very exacting in the matter of accounting, there have been no serious matters of objection on our part, and be it said to their credit that reimbursements to our State Highway Fund, on account of construction work accomplished, have been made within a very satisfactory time, considering the usual time required for such governmental activities.

The biennial period just closing has been one of constantly increasing prices; estimates made two or three years ago, and upon which federal aid was then granted, have had to be revised constantly. In the case of each revision application has been made to the bureau for a revised agreement and request made that the participation of the Federal Government be made on the basis of the revised estimate. In all except one or two of the revisions the Federal Government acceded to our desires, and have thus kept apace with the tendency for higher construction costs.

Notwithstanding the fact that, previous to the awarding of any contract, detailed plans are prepared, it is frequently found necessary to revise grade lines, change alinement, do extra work and additional work, all of which was not at first contemplated, and which has a tendency to increase the ultimate cost of the improvement; and whenever it has been found necessary to do any work of this character the matter has been taken up with the federal authorities and their approval obtained, so that in those features of our work where federal aid could legitimately be given we have been able to secure their cooperation and participation. A detailed estimate which accompanies each agreement between this department and the Federal Government contains an item providing for engineering and contingencies during the construction period; this amounts to 10% of the estimated cost of the project. By this means the Federal Government pays us one-half the cost of the engineering work made necessary during the construction period, such as the staking-out of the work and its inspection.

We have, in some cases, been able to hold our engineering costs within the limit of the 10% provision, and in other cases we have not. In most of those cases, where the engineering costs have exceeded that estimated, the fault has been due to the slowness with which the work has been carried on by the contractor.

The first procedure that is necessary on the part of the State to initiate a project is to submit to the Federal Government what is known as a "Project Statement," which is in reality a request for federal money and in which the statement is made that if the request is granted the State will proceed with the construction along the lines outlined by it in this project statement. To date there have been submitted to the Government thirty-seven statements involving construction work of a total estimated cost of \$3,778,769.16. All the statements submitted by this department have been approved by the Secretary of Agriculture.

After the statement has been approved, it is required that the plans and specifications and estimates be submitted for approval, and if they are found satisfactory the Federal Government and the Highway Department enter into a form of agreement by which the State obligates itself to proceed with the construction and secure its completion within a certain specified time limit. These agreements are called "Project Agreements" and are a direct contract obligation of the State. To date thirty such agreements have been entered into with the Federal Government, involving highway and bridge construction of a total estimated cost of \$2,658,602.43, on which the Federal Government has agreed to and has already partially paid the sum of \$1,250,283.89, the State and several counties being required to pay the balance.

The method of doing the work is outlined in considerable detail in these project agreements, and the State, in entering into such an agreement, obligates itself to the maintenance of the project for all time, and in conjunction with that it is provided that "the Highway Department will use every means within its power to insure proper and permanent maintenance of said project thereafter, and to that end will annually make an estimate of the amount necessary to properly maintain the said project and will recommend at appropriate intervals to the Legislature or other proper authority of such State that the sum so estimated be provided from time to time for such maintenance."

A part of the Federal Aid Road Act pertains to the construction of roads through, or adjacent to, the National Forests, and a separate appropriation is made for that particular purpose. This appropriation is allotted to the several States in a manner similar to the allotment of funds under the Federal Aid Road Act, and such allotments to the State of Nevada follow:

1917.....	\$19,100.00	1922.....	\$19,100.00
1918.....	19,100.00	1923.....	19,100.00
1919.....	19,100.00	1924.....	19,100.00
1920.....	19,100.00	1925.....	19,100.00
1921.....	19,100.00	1926.....	19,100.00
	<hr/>		<hr/>
	\$95,500.00		\$95,500.00
Making a total of.....		\$191,000.00	

The State Highway System as outlined crosses the National Forest in three different localities: first, east of Tonopah through the southern end of the Monitor Division of the Toiyabe Forest; second, through the Nevada National Forest in eastern Nye and Western White Pine Counties and through the northern part of the Toiyabe National Forest just east of Austin, in Lander County. The projects in the locations numbered above as 1 and 3 have been constructed as forest roads by the Federal Government in connection with aid extended by the State and counties.

The procedure necessary to be followed in the case of forest roads is almost directly opposite to that employed in connection with federal aid in that the Federal Government makes all surveys, plans, and specifications, and, in most cases, does the construction work itself, the State being required to pay at least one-half the cost of not only the construction work but of the surveys and preparation of plans. The maintenance of the project after it has been completed is required to be done by the State without assistance from the Government, except in extraordinary cases.

The money which is available to the State for use in constructing forest roads need not be confined to the State Highway System, but may be obtained by any county for road construction where the road meets the interpretation of the bureau as one which might be constructed as a forest road.

The multiplicity of the details required in connection with federal aid and forest-road projects necessitates quite an extensive administration and clerical organization, without which federal aid funds could not be obtained in order that the work itself be carried on.

MATERIAL, LABOR, AND HIGH PRICES

The biennial period just closing has been an exceptional one in the respect that there has been probably no similar era in the history of this country in which efficiency and cost of labor, the delivery of materials, and the securing of equipment have been so uncertain.

All these conditions have been reflected in no small degree in the cost of doing highway work all over the country and particularly in this State.

Unfortunately the actual building of roads commenced in this State with the inauguration of this uncertain biennial period, so that it is impossible for us to judge by comparison what are really high costs of construction and what are not. Reports from other sections of the country, however, where comparisons can be made between pre-war and post-war period, indicate that highway costs have practically doubled. One of the best comparisons is that worked up by the engineer of the County Highway Department of Cook County, Ill., which is the county in which the City of Chicago is situated. That comparison shows that a certain type of road, costing \$20,129 per mile in 1916 and \$22,523 per mile in 1917, under similar conditions cost \$41,421 per mile in 1920—an increase over the 1916 cost of 105.8%. The table from which this information is obtained appears on the opposite page.

From this table it is apparent that the great increase in the cost of materials which represent the major portion of that type of road construction was considerably more in this State than in Cook County, Ill., and that the increase in labor cost is about the same or slightly less.

Information obtained from the State Labor Commissioner shows that for over 20,000 employees in this State the average hours worked per day in 1919 is three-tenths of an hour less than in 1915 and that the daily wage is 78 cents more in 1919 than in 1915. The employees enumerated above include every one receiving salary or wages. It is a fact, however, that increases have been more pronounced and greater among those engaged in construction work, such as the building of highways, than among those occupying clerical positions. It is difficult,

however, to state what the actual increase in wages for highway construction has been, for the reason that no direct comparison can be made with pre-war conditions.

Not only was there a large increase in the cost of labor, but it is a fact that the efficiency, generally speaking, was considerably lowered, and this last caused more concern among contractors than the increase in wages. It is apparent to any one that, with the labor cost doubled and the efficiency lessened to the extent of 50%, the contractors or the department employing such labor were only receiving about one-quarter of the value as compared with conditions as they existed in 1915 or previous years. All during this biennial period except at its close there has been a dearth of labor, more pronounced in some parts of the State than in others. So acute was this condition in some sections that it was practically impossible to carry on highway construction at all. This was true particularly in Elko County, where

INCREASE IN PRICE OF CONCRETE ROAD CONSTRUCTION IN COOK COUNTY - ILL. Width - 18 Ft. Shoulders 6 Ft.						
	1916	1917	Per Cent Increase	1920	Per Cent Increase Over 1916	Per Cent In- crease Over 1917
Total Cost of Road	\$75,886.00	\$84,911.59	11.9	\$156,156.05	105.8	84.0
Total Cost of Road Per Mile	20,129.00	22,523.00	11.9	41,421.00	105.8	84.0
Total Cost of Materials Per Mile	11,875.00	13,365.00	12.9	21,255.00	79.0	59.0
Total Cost of Labor Per Mile	8,254.00	9,158.00	10.95	20,166.00	144.5	120.0
Cost of Labor Per Hour	.25	.40	60.0	1.00	300	150
Cost of Teams Per Hour	.60	.75	25.0	1.10	83.4	45.7
Cost of Cement Per BBL	1.46	1.76	20.5	2.03	39.0	15.4
Cost of Sand Per Cubic Yard	1.10	1.15	4.5	2.25	104.5	95.6
Cost of Gravel and Stone Per Cubic Yard	1.10	1.15	4.5	2.25	104.5	95.6
Cost of Steel Per Pound	.04	.045	12.5	.07	75.0	55.6
Cost of Lumber Per M	30.00	40.00	33.3	73.00	143.0	82.5
Cost of Freight Per Ton	.40	.40	0.0	.60	50.0	50.0

for the season of 1919 the contractor was unable to secure but a very small percentage of the men who were necessary to carry on his work.

For long periods of time the various labor agencies throughout the State were constantly besought by highway contractors for men whom they were unable to supply except to the extent of partial requests.

It was called to our attention at different times that the inauguration of new highway contracts in some sections of the State would so seriously hamper agricultural pursuits and local industries that it would be inadvisable to divert labor to highway construction, and when such conditions have been brought to our attention we have given the matter serious thought and have acceded to the demands of the local industries.

The lowered efficiency of labor, its higher price, and the difficulty to obtain it at all have been reflected to a full degree in the prices which

have been paid upon our work, and we have had in some manner or other to pay for all of this in an indirect way, and where it has been necessary for us to employ labor ourselves, such as on the construction of the plant at Lahontan and on our various maintenance operations, we have had to pay for all of it directly, and we can understand more fully the difficulties with which contractors have had to contend during this biennial period.

Not only has this condition cost the State a considerable amount of money, but it has also had a large tendency to cause delays in completion of the various projects, so that where it had been anticipated that a project would be completed on a certain date it would actually not be finished until several weeks and in some cases months later. The none-too-good labor condition has not been seen without some benefit, for the reason that it has forced every one who has to do with highway construction into the larger use of labor-saving machinery, which will continue long after those conditions become better.

Construction work of the kind handled by this department requires the use of a considerable amount of material other than the so-called road-building materials and the obtaining and use of a very large amount of road-building equipment and machinery. During this biennial period all of these have been very difficult, if not impossible, to obtain. The one item of barbed wire, which is used for fencing our rights of way, has been almost impossible to secure—in fact, at one time it was obtainable only after a wait of five to six months, and at the time this report is written an order has been standing for a period of about an equal length.

Equipment has been difficult to acquire by all of the contractors, and considerable delay has been caused by their not being able to secure what they wanted at the time of commencement of operations, or by the fact that they have had to take some substitute which did not fill all of the requirements the work demanded.

The Lahontan plant required the purchasing in the open market of a very large quantity of machinery, and its delayed completion was due to the poor market conditions existing at the time of its construction.

At the beginning of the working season of 1920, due to a very unfortunate contract which the department had awarded for the purchasing of crushed stone, we had no stock of sand or gravel available, and consequently were forced to construct a plant of our own and commence delivery from it at the same time paving operations were started. There were periods during the season when our ability to supply this class of material was not of the best, but, viewing the matter as a whole and considering conditions as they existed in other parts of the country, we are confident that the minimum of delays was encountered on this account.

We had fortunately entered into a very good contract for the furnishing of cement to us from California mills, and deliveries, we do not believe, were better in any other section of the country; this was due in great part to the fine cooperation given us by the Flanigan Warehouse Company of Reno.

On April 12 of the present year a new contract was awarded for 70,000 barrels of cement, to be delivered as required in 1920, and at the close of the season we were purchasing cement under this contract

cheaper than the United States Government, the State of California, or the counties in California doing considerable highway work. Certainly deliveries have been better to us, for an investigation during the middle of the season disclosed many contracts closed down in California for want of this very material. An unfortunate circumstance occurring during the middle of the season was the curtailment of power in California, which made necessary the lessening to a very large degree of the output of the various cement companies.

GOVERNMENT EQUIPMENT

At the meeting of the American Association of the State Highway Officials, held in Chicago in December, 1918, a request was made of Congress that through appropriate legislation provision be made to distribute to the various States such equipment and supplies, which the Government had purchased for war purposes and were no longer needed, as might be useful for road construction and maintenance.



Fifteen-foot Gravel Road in Pershing County. Project 19, Contract 26.

Section 7 of the Postoffice Appropriation Bill of the Sixty-fifth Congress reads as follows:

That the Secretary of War be, and he is hereby, authorized in his discretion to transfer to the Secretary of Agriculture all available war material, equipment, and supplies not needed for the purposes of the War Department, but suitable for use in the improvement of highways, and that the same be distributed among the highway departments of the several States to be used on roads constructed in whole or in part by federal aid, such distribution to be made upon a value basis of distribution the same as provided by the Federal Aid Road Act, approved July 11, 1916; *provided*, that the Secretary of Agriculture, at his discretion, may reserve from such distribution not to exceed 10 per centum of such material, equipment, and supplies for use in the construction of national forest roads or other roads constructed under his direct supervision.

While this authorization was anything but definite and not all that could be desired in other respects, we received a considerable quantity of equipment under its provisions.

A long time elapsed after the passing of the legislation before any equipment was actually distributed. It appeared necessary for the Secretary of War to determine first just what equipment might be made available for distribution, and just what might be needed for the purposes of the War Department.

The Motor Transport Corps had charge of the motor vehicles, and it was difficult for them to determine what they desired to keep for current work and possible future emergencies. The War Department had already commenced the sale of considerable equipment and supplies of all characters, and it seemed difficult to determine what should be sold, what should be retained, and what distributed to the States for road-building purposes.

This war equipment and material was to be distributed over the country, and considerable of it was in France.

On account of the ordinary time for governmental action and the extraordinary conditions surrounding this equipment and material, no distribution was made for a long period of time after the legislation was obtained.

During this period when it was impossible for us to secure equipment, it was likewise impossible to get any information of what might later be available to us. Altogether the commencement of the work of distribution was unsatisfactory to the several States.

Finally, however, certified lists were given to the Bureau of Public Roads and they, after deducting the equipment which they wished to retain, began the distribution to the various States.

Under this first Act the States were given the equipment free of any charge except that of its crating, loading, and freight. Compared with most States, this was obviously not fair to those States, such as our own, which were far removed from the various Army posts and supply centers where the equipment and material were located. A State situated like New York could secure a truck by merely driving it perhaps less than 100 miles, while we, in our isolated position, would be required to pay as much as \$500 for freight charges alone on each truck.

It was found during the first year of this distribution that, if the several States were to receive all of the equipment they desired, it would be necessary to secure the enactment of new legislation, and new legislation was also desirable to make the expense of this distribution equitable to the several States.

This objection culminated in the passing at the second session of the Sixty-sixth Congress of what was known as the Kahn Bill which, in so far as it pertains to the distribution of excess war material and equipment to the various States, is as follows:

A Bill to authorize the Secretary of War to transfer certain surplus motor-propelled vehicles and motor equipment and road-making material to various services and departments of the Government and for the use of the States.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That

the Secretary of War be, and he is hereby, authorized and directed to transfer such motor-propelled vehicles and motor equipment, including spare parts, pertaining to the military establishment as are or may hereafter be found to be surplus and no longer required for military purposes, to (a) the Department of Agriculture, for use in the improvement of highways and roads under the provisions of section 7 of the Act approved February 28, 1919, entitled "An Act making appropriations for the service of the Postoffice Department, for the fiscal year 1920, and for other purposes"; *provided, however*, that no more motor-propelled vehicles, motor equipment, and other war material, equipment, and supplies, the transfer of which is authorized by this Act, shall be transferred to the Department of Agriculture for the purposes named in section 7 of said Act than said Department of Agriculture shall certify can be efficiently used for such purposes within a reasonable time after such transfer. * * *

SEC. 2. That the Secretary of War is hereby authorized and directed to transfer to the Department of Agriculture under the provisions of section 7 of the Act approved February 28, 1919, entitled "An Act making appropriations for the service of the Postoffice Department for the fiscal year 1920, and for other purposes," for use in the improvement of highways and roads, as therein provided, the following war material, equipment, and supplies pertaining to the military establishment as are or may hereafter be found to be surplus and not required for military purposes, to wit: road rollers, graders, and oilers; sprinkling wagons, concrete mixers; derricks; pile-driver outfits complete; air- and steam-drill outfits; centrifugal and diaphragm pumps with power; rock crushers; clamshell and orange-peel buckets; road scarifiers; caterpillar and drag-line excavators; plows; cranes; trailers; rubber and steam hose; asphalt plants; steam shovels; dump wagons; hoisting engines; air-compressor outfits with power; boilers; drag, Fresno, and wheel scrapers; stump pullers; wheelbarrows; screening plants; wagon loaders; blasting machines; hoisting cable; air hose; corrugated-metal culverts; explosives and exploders; engineers' transits; levels, tapes, and similar supplies and equipment; drafting machines; planimeters; fabricated bridge materials; industrial railway equipment; conveyors, gravity and power; donkey engines; corrugated-metal roofing; steel and iron pipe, wagons, and similar equipment and supplies, such as are used directly for road-building purposes.

SEC. 4. That freight charges incurred in the transfer of the property provided for in this Act shall not be defrayed by the War Department, and if the War Department shall load any of said property for shipment the expense of said loading shall be reimbursed the War Department by the department to which the property is transferred by an adjustment of the appropriations of the two departments; *provided, however*, that any State receiving any of said property for use in the improvement of public highways shall, as

to the property it receives, pay to the Department of Agriculture the amount of 20 per centum of the estimated value of said property, as fixed by the Secretary of Agriculture or under his direction, against which sum the said State may set off all freight charges paid by it on the shipment of said property not to exceed, however, said 20 per centum.

SEC. 5. That the title to said vehicles and equipment shall be and remain vested in the State for use in the improvement of the public highways, and no such vehicles and equipment in serviceable condition shall be sold or the title to the same transferred to any individual, company, or corporation.

It is noted that this legislation directs the transfer of such equipment as will be no longer required for military purposes, that the freight charges and other expense incidental to the transfer are to be paid by the War Department. The States, however, are to reimburse the War Department to the extent of 20% of the estimated value of said equipment.

Under these two Acts of Congress we had received up to and including November 18, 1920, equipment and material of a value estimated to be \$766,527.05, at a total cost to the State of \$79,929.86, or approximately 10% of the estimated value.

A table giving the detailed list of the equipment and supplies which have so far been received, estimated value, cost to us, and disposition of same, follows this report.

Some of the equipment which we have received was not in the best of condition—in fact, in some cases it was considered little better than junk, worth, however, more than the transportation charges. In this matter we were more fortunate than most of the States, believing that, as a whole, the equipment which we have received was in a considerably better average condition. Be that as it may, we had no choice in the matter except to accept or reject that which had been allotted to us without the privilege of making an examination of it.

We have not received in all cases the equipment which we most desired; particularly is this true of that type of equipment most commonly used on road work, such as plows, road graders, road scrapers, etc. It is not believed that the War Department at the cessation of war had any great amount of equipment of this character on hand. It is certain, however, should a distribution be made of this character of equipment, that we will receive our proper share of it.

This equipment has been received by the State for three purposes: first, for road construction and maintenance to be done by state forces; second, for rental to contractors; and, third, for distribution to the various counties and municipalities for road and street work not under the jurisdiction of the Highway Department.

The various cities, towns, and counties are required to reimburse the Highway Department for the actual expense incurred in securing such material and equipment as has been distributed to them. In many cases to the initial expense we have had to add the actual cost of making small necessary repairs to the equipment. In any event the Highway Department has not received any profit.

Considerable thought has been given and much investigation made of the rental of this equipment to various contractors, and in our

determination of a method we have been guided very largely by the practice in other States. It is admitted that our method is not beyond criticism by the contractors, but at the same time it is thought to be the best one that can be worked out with the interests of the contractors and the State both in mind. The method we have adopted, and the one which is in use at the present time, is represented by the following rental contract form:

THIS AGREEMENT, Made and entered into this.....day of, 192...., between C. C. Cottrell, State Highway Engineer, acting by and for the Department of Highways of the State of Nevada, hereinafter referred to as Highway Department, and....., hereinafter referred to as the Contractor.

It is accordingly covenanted and agreed as follows: That for and in consideration of the sum herein named, and certain conditions to be fulfilled by the contractor, the Highway Department agrees to lease to the contractor, for use in constructing roads in the State of Nevada, certain motor trucks and other equipment which it may have available for said purpose.

The Highway Department will furnish all of said trucks and other equipment to the contractor in good condition at the nearest state storage house, and the contractor hereby agrees that any of said trucks or other equipment he may select is in good condition at the time of said acceptance by him; it being expressly understood that if the equipment was in other than good condition he, the contractor, would not have accepted it.

The Highway Department will be responsible for the license fee, and agrees to furnish all tires for trucks and to keep tires in repair while said vehicles are leased to the contractor.

The Highway Department reserves the right to recall any or all of the equipment leased here by the contractor by giving him five days notice.

The contractor agrees to employ only competent truck drivers, and assumes the entire responsibility for the use and care of the equipment while in his possession. The contractor further agrees that he will remove immediately any operator of said equipment upon request of a representative of the Highway Department.

It is agreed that, except for tires on motor trucks, the contractor will assume and hereby agrees to assume all the expense of operation and repairs of whatever nature, and that when the equipment is returned to the Highway Department it shall be returned in at least as good a condition as when received, reasonable wear and tear only excepted. The contractor agrees to make all repairs in a manner satisfactory to authorized representatives of the Highway Department.

The contractor agrees to operate trucks both as to load and speed within limits prescribed by the manufacturer or such other limits as may be specified in writing by the Highway Department.

The contractor agrees, in addition to the observance of all

the conditions herein set forth, to pay to the Highway Department rental as follows:

For each and every 2-2½ ton truck.....\$10.00 per day.

For each and every 3-3½ ton truck.....\$12.50 per day.

For each and every 4-4½ ton truck.....\$15.00 per day.

For each and every 5-6 ton truck.....\$17.00 per day.

It is agreed that the rental be for each and every day (Sundays and holidays included) for each and every piece of equipment from the day delivery is taken by the contractor at the state storage yard until it is returned to the same place, with the following exceptions:

First—Sundays and holidays when the equipment is not used.

Second—Periods when the weather, or other conditions over which the contractor has no control, prohibits the use of the equipment.

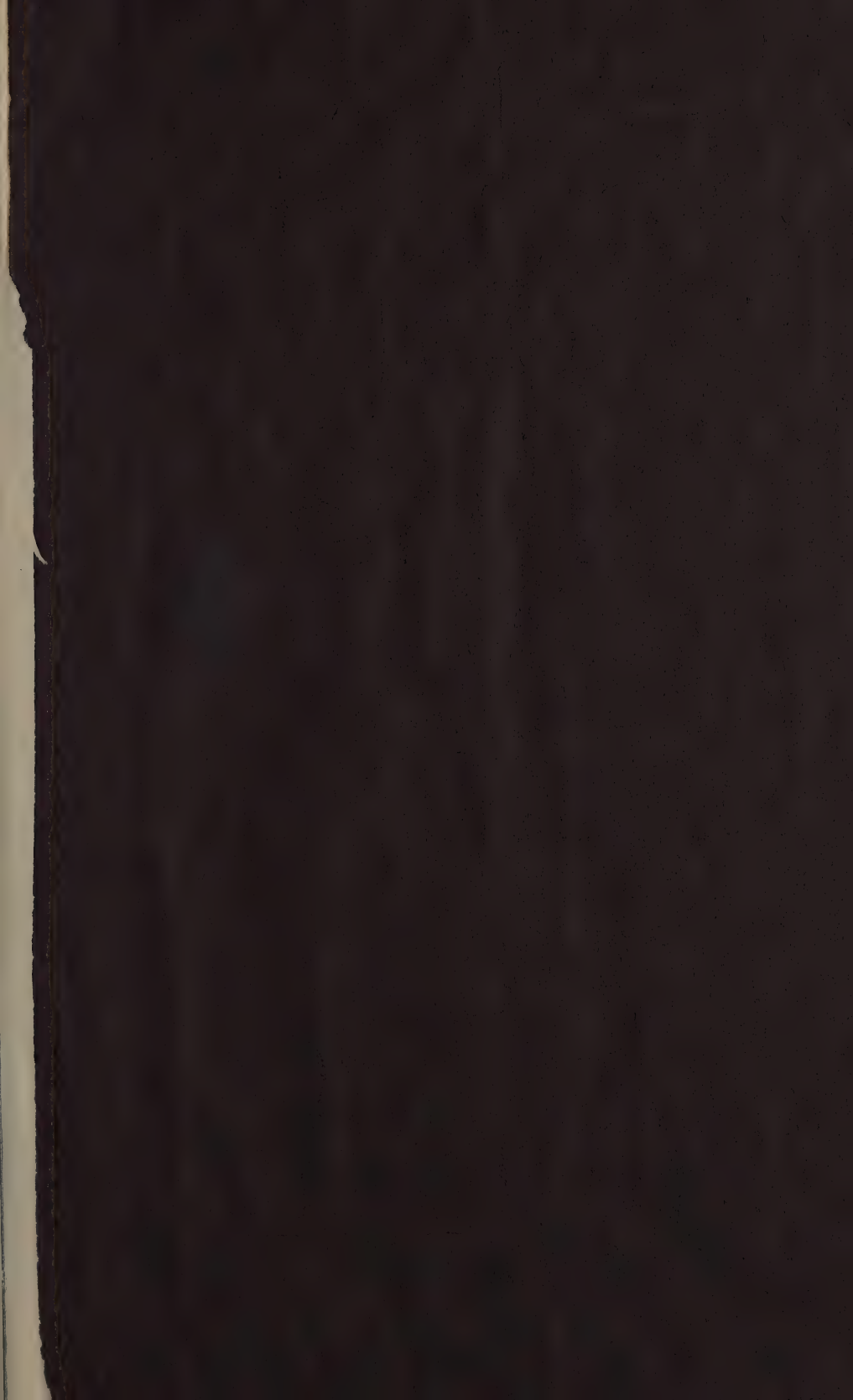
The contractor agrees that at the time of such nonuse of equipment and at no other time he will secure a written statement from the nearest representative of the Highway Department that such nonuse was necessitated by one of the above contingencies; otherwise the said contractor agrees to pay for each and every day the equipment is in his possession.

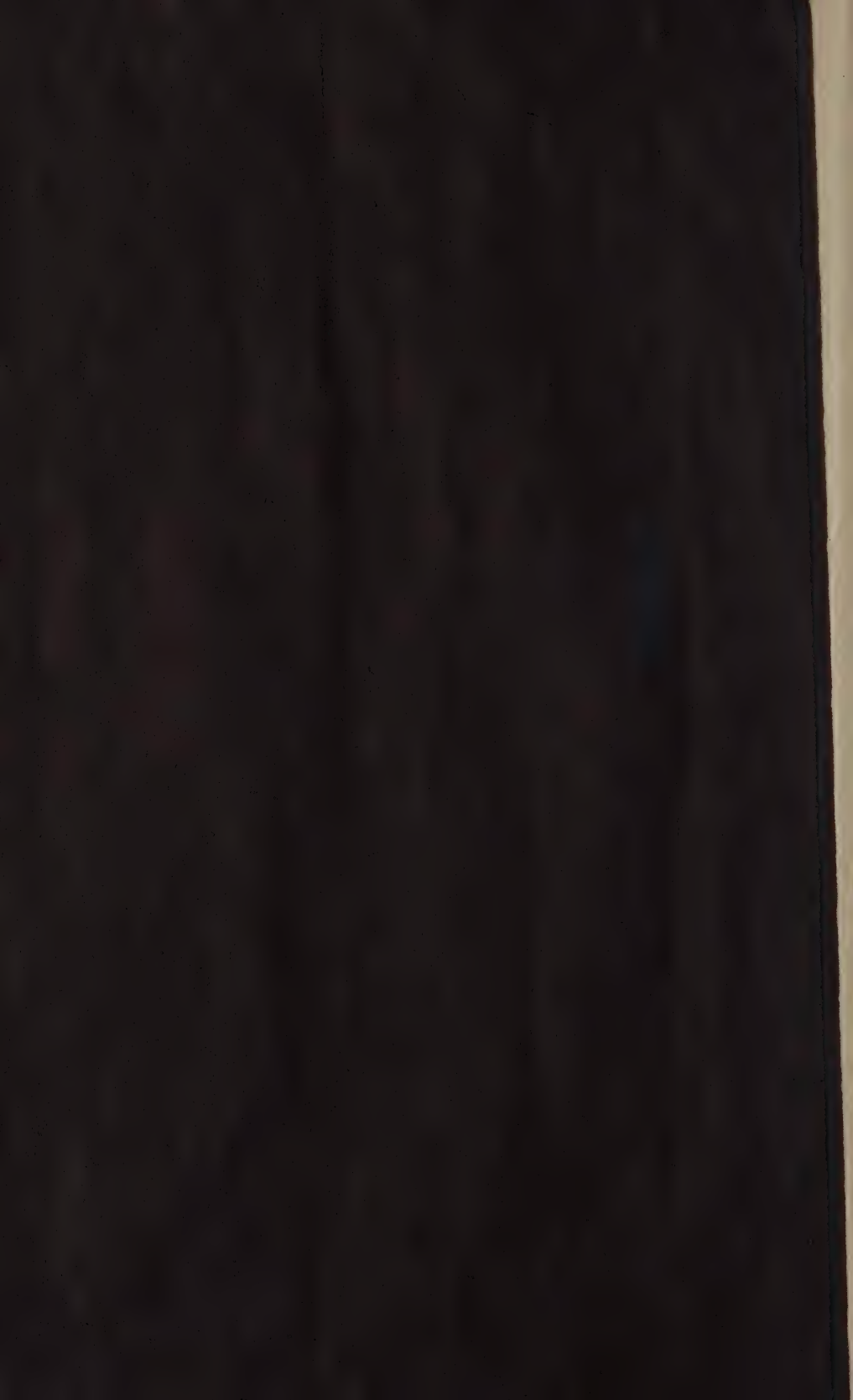
It is agreed that the Highway Department will, on the first day of each month or immediately thereafter, send an itemized statement to the contractor of the amount due said Highway Department on account of the rental of equipment during the preceding calendar month, and the contractor agrees within twenty (20) days thereafter to pay to the State Treasurer of the State of Nevada (by mailing to the State Highway Engineer, Carson City, Nevada) the full amount of said statement, and it is agreed that, should the contractor neglect or fail to pay for said rental as aforesaid, the Highway Department is given the right to deduct the same from any money that is then or might later be due said contractor.

It is mutually understood and agreed that the terms of this agreement are to be changed in no manner, except by written consent of the parties hereto, and that there is to be no other understanding of any nature whatever respecting the rental of equipment except as contained herein or in the manner provided for.

The matter of the rental charge itself is one to which much thought has been given, and in determining it consideration has been given to the cost of renting trucks and equipment from private individuals and firms, also to the cost to the State of keeping this equipment in first-class condition. In addition to the above two considerations, a rental which will net the State a profit over and above the keeping of the trucks in good repair is desirable in order to provide a sinking fund for the purchase of new equipment in future years, for it must be remembered that, no matter how well at present equipment is kept in repair, it is only a question of time, and in some cases a very short time at that, until it is entirely worn out or becomes obsolete in type.

Due to the fact that the matter of rental of equipment to contractors is new in this State, and because no expensive repairs have so far been





SURVEYS AND PLANS

Much has been said and written in the last decade relative to the advisability of the detailed study given to the location and designs of our highway systems. In spite of arguments sometimes advanced by the layman, it has been shown in practice beyond the question of a doubt that the cost of this preliminary study is the best possible investment, in that it makes for (1) a comprehensive system of highways, (2) the most economical construction costs, (3) the best alinement, grades, and drainage conditions, and (4) a preknown construction estimate without which no system of financing proposed future construction can be worked out. It is also a requirement of the Federal Aid Road Act that, before the Government will advance moneys to the States for aid in highway construction, detailed surveys shall be made, and complete plans, specifications, and estimates prepared.

The task of locating our State Highway System may be divided into three distinct classes:

- (1) The selection, in a general way, of the various routes. To the extent that certain centers of population and outstanding topographical features were mentioned as points through which the state highways should pass, this selection was made, and a description of the various routes was given in the State Highway Act;
- (2) The reconnaissance survey, by means of which the general location of the highway between two fixed points is determined; and
- (3) The location survey, by means of which the details of alinement and grade between points located on the reconnaissance survey are worked out.

The description of Route 3, as defined in the State Highway Act, is typical of the selection of routes made by the language of the Act. To quote the Act, Route 3 is defined as "commencing at the city of Reno, thence running southerly through the city of Carson City; thence westerly to Glenbrook on Lake Tahoe; thence in a southerly direction to the Nevada-California state-line at or near Lakeside; beginning again at Carson City, thence to the town of Yerington by the most available and practicable route; thence to the northerly end of Walker Lake by the most available and practicable route; thence along the west side of Walker Lake to the town of Hawthorne; thence to and through the towns of Luning, Mina, and Millers to the town of Tonopah; thence southerly to the town of Goldfield; thence westerly by the most practicable and available route to the Nevada-California state-line." It will be seen that the highway route as described above must run from Carson City to Yerington by "the most available and practicable route." There are many factors entering into the final determination of the most available and practicable route, some of the most important of which are the economic values of the various possible routes from the standpoint of the number of people served, the present valuation of the country traversed, and the possibilities of future development; the distances between the two control points; the maximum grades; and the elevations of summits as determining whether or not the road will be blocked with snow during the winter months. These and many other factors are given serious consideration and weight by the Board of Directors and the State Highway Engineer in the study of the various possible routes, and a decision is

reached only after a complete investigation embracing every side of the question has been made.

When a decision is made as to the most available and practicable route between two fixed points as described in the Highway Act, the reconnaissance survey is begun. The reconnaissance survey consists of a general examination of the country through which the proposed road is to run, to the end that its main topographical features may be located in reference to the proposed location of the road. The selection of a route may be a simple or a very difficult proceeding, depending upon the topography of the country traversed and particularly upon the location of rivers and summits. If the line follows a river, the problem is comparatively simple, in that there is then to decide merely which river bank to follow. This is usually readily decided by weighing the probable costs, but other considerations, such as snow conditions, property values, etc., must be given due weight. When it is not possible to follow a river, the difficulties in selecting a line are increased, particularly so if the watercourses are found to run nearly at right angles to the general direction of the road. The reconnaissance engineer must then investigate all possible passes and summits, and select the best stream crossings. He must investigate soil and drainage conditions, the availability of rock, sand, water, and other road-building materials, the ruling grade to be adopted, and the sharpest curve to be used. He determines upon the best way to negotiate difficult topographical features and the best location for the highway to overcome snow difficulties. He must bear in mind the probable maintenance cost, and give weight to this question in his recommendations. When his investigations are complete, he has generally selected two or more possible lines, all of which follow, in a general way, the main adopted route. Preliminary estimates, based upon experience in constructing similar roads through similar country, are prepared, and these estimates, together with the topographical and other data submitted, are carefully weighed in the final selection of the line to be adopted. Generally speaking, the selection of a specific line can be made on a basis of the reconnaissance engineer's report and a field study of the proposed lines. It is sometimes necessary, however, on account of the equal desirability and cost of two or more lines, to stake out each of them, and the final determination cannot then be made until the lines are finally located and complete plans and estimates prepared.

When a line has been selected, a location party, consisting of a locating engineer and four or more assistants, is sent into the field and the location details are worked out. The reconnaissance engineer has previously determined the main topographical features through which the located line must pass, and it remains for the locating engineer to connect these predetermined "control points" with the best possible line. He studies the local soil, foundation, and drainage conditions in great detail, and often swings his line out of the most direct route in order to take advantage of better ground. The data compiled by the locating engineer are the basis for the preparation of plans and estimates, the acquiring of rights of way, and the awarding of the contract for constructing the road. It is possible for the locating engineer to effect an ultimate saving of sometimes thousands of dollars per mile by running two or more lines through difficult country, and it is therefore obviously well worth the cost and effort necessary to do this work. His

location notes must contain detailed alinement data, profile, and cross-sections, which give the elevations, not only of all points on the center line, but of each side of the line as well; the names of property owners, and distances and angles to their property corners; drainage notes, and recommendations as to the various sizes of bridges and culverts required; soil and foundation conditions, the composition of the sub-soil, whether earth, sand, loose rock, or solid rock, and the percentages of each; the location and size of local sand, gravel, and rock deposits and their availability for construction purposes; the location of natural and artificial topography, such as railroads, telephone lines, houses, fences, etc., and, in fact, all data necessary for the preparation of a detailed map of the country traversed, and an accurate estimate of cost. In spite of the great amount of information required from our locating parties, we have been able to keep the cost of our completed located line down to \$138.20 per mile, which compares very favorably with the cost per mile in every other State in the Union, and is certainly justified when the advantages of a properly located highway, and the ultimate saving in construction costs effected thereby, are considered. We have located to date 756.65 miles of line, or 39.82% of the total mileage of our State Highway System. The map on page 34 will show the extent of reconnaissance and location surveys made to date.

In the preparation of plans, specifications, and estimates, we conform to the requirements of the most modern practice, and are guided in our efforts by certain standards established by the Bureau of Public Roads. The present form and arrangements of our plans is the result of the study of a set of plans furnished this department by every state highway department in the United States. We have attempted to embody into our plans the best features of each of the sets submitted, and to eliminate the bad features. Everything that can be standardized is printed on the layout sheets, thus eliminating slow and costly repetition of work. From the notes submitted by the location party, the alinement map, the profiles, and cross-sections are worked up, and an estimate is computed. In order that this estimate may be the best economical possible, a great deal of care is necessary. In side-hill work the material taken from the cuts must just equal that required to make the fills, and to this end considerable refinement must be used in establishing the elevation of the finished roadway above or below the ground surface. A great deal of money can be wasted by not giving this point sufficient study. In rough mountainous country it is often possible to save money by shifting the center line one way or another to lessen the work. These matters must all be investigated to insure an economical design. The completed plans must be in sufficient detail to enable the contractors to work up an intelligent bid for the work to be done, and must serve as a guide to our engineers during the construction period. Deeds must be written and deed maps drawn up for each piece of right of way to be acquired. This feature is a costly one, but it is a requirement of the Federal Government that the State furnish the rights of way at its own expense. We have to date prepared plans and estimates covering 377.75 miles of highway, at a cost of \$54.03 per mile. This cost is low, considering the character of the country traversed and the value of the designs, and compares favorably with the mile-cost of other state highway departments.

TABLE SHOWING COST PER MILE OF

County	Route	Section	From	To	Miles final location as shown in 1918 report	Miles final location surveyed 1919- 1920	Total miles located line	Miles plans com- plete 1917-1918
Washoe	1	A	State Line	Reno		9.95	9.95	
Washoe	1	B	Reno	Vista Station		3.96	3.96	
Pershing	1	B	Toulon	Lovelock		3.92	3.92	
Pershing	1	C	Lovelock	Zola	18.35		16.70	16.88
Pershing*	1	D	Zola	Mill City		27.81	27.81	
Humboldt	1	C	Golconda	Stone House		12.08	12.08	
Humboldt	1	D	Stone House	East County Line		10.85	10.85	
Lander	1	A	West County Line	East County Line	45.40		28.45	5.00
Eureka*	1	A	West County Line	East County Line	32.10	6.99	27.25	
Elko*	1	A	West County Line	Elko	31.00		29.05	18.73
Elko*	1	B-1	Elko	Halleck		20.56	20.56	
Churchill	2	A-1	Hazen	Leeteville		8.29	8.29	
Churchill	2	B	Leeteville	Fallon	8.12		7.62	7.62
Churchill	2	C	Grimes Ranch	Sand Springs		17.03	17.03	
Churchill	2	D	Sand Springs	West Gate		11.69	11.69	
Churchill	2	E-1	West Gate	East Gate		11.50	11.50	
Eureka	2	B	Hay Ranch	Eureka		12.17	12.17	
White Pine	2	B-1	Pancake Summit	Little Antelope Summ.		12.50	12.50	
White Pine	2	B-2	Little Antelope Sm.	Illpah		10.42	10.42	
White Pine	2	C	Illpah	Keystone	13.88		13.58	12.46
White Pine	2	C-3	Keystone	Ely		5.88	5.88	
White Pine	2	D	Ely	McGill		12.69	12.69	
White Pine	2	E	McGill	Indian Creek		17.65	17.65	
White Pine	2	F	Indian Creek	Schellbourne		9.49	9.49	
Esmeralda	3	C	Goldfield	Tonopah	23.20		23.20	8.93
Mineral	3	D	Hawthorne	Cottonwood Creek		12.99	12.99	
Mineral*	3	E	Cottonwood Creek	Schurz	10.70		9.33	
Lyon	3	B	Yerington	Wilson's Station		12.56	12.56	
Lyon	3	C	Wilson's	Hudson-Aurora Road	6.89		0.04	6.89
Lyon	3	D	Hudson-Aurora Rd.	Douglas County line		4.69	4.69	
Douglas	3	A-1	Lyon County line	Walker River bridge		4.72	4.72	
Douglas	3	B-1	Mountain House	Carter's Station	7.10		7.01	4.00
Douglas	3	B-2	Carters	Gardnerville		11.48	11.48	
Douglas	3	B-3	Gardnerville	Minden		1.76	1.80	
Douglas	3	C-1	Minden	3½ miles north		1.80	1.65	1.80
Douglas	3	C-2	3½ miles N. Minden	North County Line		8.15	8.15	
Ormsby	3	A	Douglas Co. Line	Carson City		3.12	3.12	
Ormsby	3	C	Carson City	Lakeview	0.72		2.76	0.37
Washoe	3	A	Lakeview Summit	Huffakers	19.80		19.79	9.32
Washoe	3	B	Huffakers	Reno	5.30	0.12	5.42	4.00
Nye*	4	A-1	Tonopah	Toiyabe Natl. Forest	17.72		14.75	14.75
Nye	4	D	Nyala	Forest bdy., Currant		39.00	39.00	
Clark and Nye	5		Las Vegas	Beatty		118.00	118.00	
Clark	6	D	Las Vegas	Half-way, St. Thomas		13.31	13.31	
Clark	6	E	Half-way point	St. Thomas		40.51	40.51	
Clark	6	F	St. Thomas	Bunkerville		16.51	16.51	
Clark	6	G	Bunkerville	Utah State Line		6.19	6.19	
Washoe			Reno	Purdy		15.29	15.29	
Totals					242.08	551.90	756.65	110.75

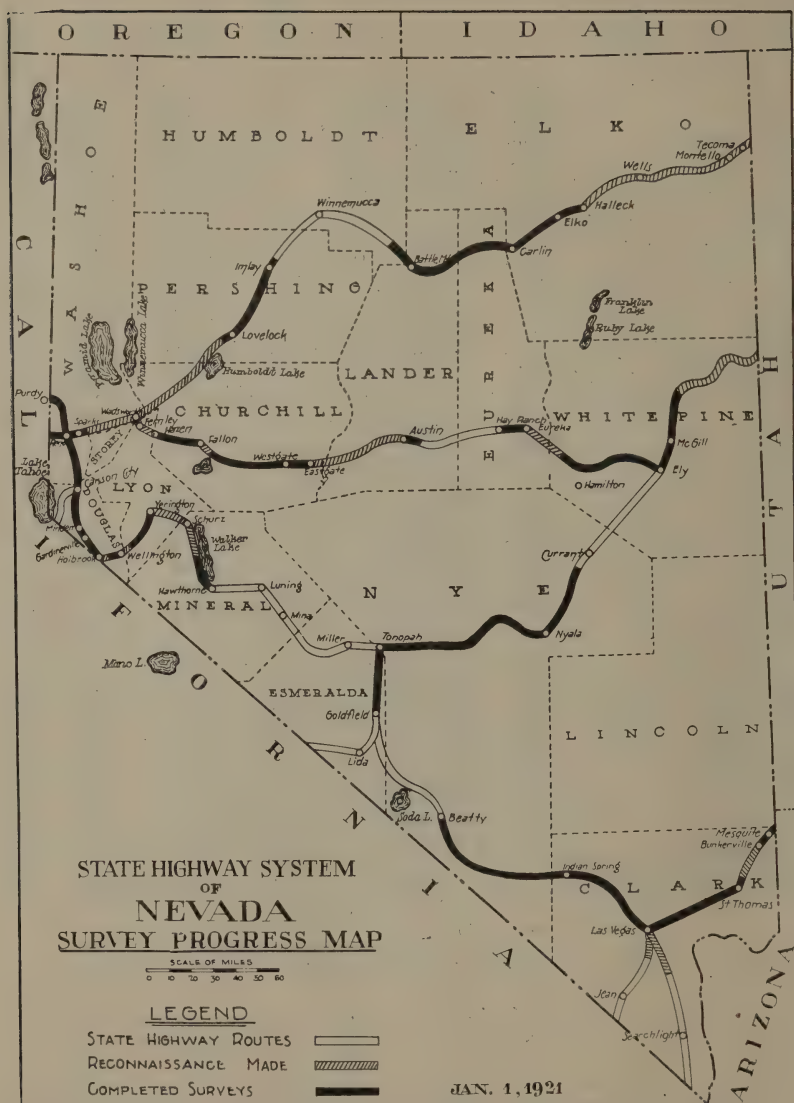
*Reduction on amount previously reported too high.

†Includes line in city of Elko.

‡Includes cost of bridge plans of special design.

SURVEYS AND PLANS, 1917 TO 1920, INCLUSIVE

Miles plans complete 1919-1920	Total miles plans complete	Cost of surveys 1917-1918	Cost of surveys 1919-1920	Total cost of surveys	Cost per mile of surveys	Cost of plans and estimates 1917-1918	Cost of plans and estimates 1919-1920	Total cost plans and estimates	Cost per mile plans and estimates
0.97	0.97		\$3,132.16	\$3,132.16	\$314.79		\$5.62		
			421.03	421.03	106.32		148.17		\$152.75
			50.16	50.16	12.80		7.26		
			417.92	1,923.19	115.16		258.83		51.60
27.81	27.81	\$1,505.27	2,483.09	2,483.09	89.29	\$602.81	1,463.71	1,463.71	52.63
			1,504.93	1,504.93	124.58		21.08		
3.00	3.00		1,199.64	1,199.64	110.59		20.35		6.78
3.52	8.52	2,579.75	72.01	2,651.76	93.21		249.49		47.29
6.31	6.31	2,754.34	3,082.45	5,836.79	214.19		678.24		107.49
8.34	27.07	3,209.13	547.65	3,756.78	129.32		549.26	1,176.86	43.47
19.83	19.83		2,981.52	2,981.52	145.02		544.32	544.32	27.45
8.29	8.29		1,493.36	1,493.36	180.07		470.97	470.97	56.79
	7.62	840.30	309.87	1,150.17	150.94	592.00	104.00	696.00	91.34
10.42	10.42		1,587.07	1,587.07	93.19		289.96	289.96	27.83
			1,637.92	1,637.92	140.11		20.65	20.65	
			1,653.17	1,653.17	143.70		7.02	7.02	
12.17	12.17		903.04	903.04	74.20		681.22	681.22	55.98
			1,442.90	1,442.90	115.43		9.01	9.01	
			1,442.91	1,442.91	138.48		37.42	37.42	
	12.46	2,869.28	1,322.62	4,191.90	152.65	385.86	136.04	521.90	41.89
2.00	2.00		1,217.99	1,217.99	207.14		237.16	237.16	118.58
			1,984.39	1,984.39	156.37				
			835.96	835.96	47.36				
			650.17	650.17	68.51				
1.73	1.73		1,013.57	1,013.57	78.03		91.94	91.94	53.14
9.33	9.33	2,907.97	7,328.90	10,236.87	1097.20		1,468.80	1,468.80	157.43
	8.93	1,142.67	56.65	1,199.32	51.69	266.40	241.88	508.28	56.92
12.56	12.56		2,137.29	2,137.29	170.17		725.34	725.34	57.75
0.04	6.93	2,672.90	544.64	3,217.54	464.29	1,225.30	391.64	1,616.94	233.32
2.31	2.31		1,038.43	1,038.43	221.41		379.01	379.01	164.07
			1,327.77	1,327.77	281.31				
	4.00	859.10	97.18	956.28	136.42		123.41	358.74	89.69
2.00	2.00		706.14	706.14	61.51		179.77	179.77	89.88
1.80	1.80		584.80	584.80	324.89		356.12	356.12	197.84
1.65	3.45	105.24	581.31	686.55	199.00	47.35	180.38	227.73	66.01
			1,272.29	1,272.29	156.11		121.73	121.73	
			216.94	216.94	69.53				
			568.77	886.86	254.84	36.29	362.20	398.49	114.51
3.11	3.48	318.09	3,343.30	8,054.69	407.01	747.73	1,834.49	2,582.22	130.48
10.47	19.79	4,711.39	367.36	982.95	181.36	296.91	316.30	613.21	113.14
1.42	5.42	615.59	5.20	1,189.82	80.67	254.17	136.82	390.99	26.51
	14.75	1,184.62	4,064.88	4,064.88	104.23		178.02	178.02	39.56
4.50	4.50		1,186.35	1,186.35	10.05		50.16	50.16	0.59
85.00	85.00		813.52	813.52	61.12		5.00	5.00	
			8,296.75	8,296.75	204.81		200.71	200.71	15.08
13.31	13.31		4,376.53	4,376.53	265.08		16.21	16.21	
			2,228.06	2,228.06	359.94		466.32	466.32	
15.29	15.29		1,765.40	1,765.40	115.46		1,173.26	1,173.26	76.73
267.18	377.75	\$28,275.64	\$76,295.96	\$104,571.60	\$138.20	\$5,471.16	\$14,939.29	\$20,410.45	\$54.03



BRIDGES AND DRAINAGE STRUCTURES

There is an axiom of road construction that "A road is no better than its foundation." To sustain the weights of the surface and traffic and keep the surface from disintegrating under the pounding of traffic, the foundation must be firm and unyielding, which means that it must be properly drained. For this reason, all projects are receiving careful consideration at the time that surveys are made, in order that the road will be located on such material and in such a way that it can be readily drained. A careful study of the entire project is made prior to preparing plans, so that bridges and culverts of sufficient capacity and proper location will be provided. Borrow ditches, when necessary, are constructed on such a grade that water collecting therein will be carried to a watercourse and thence away from the road.

A large portion of the area of our State is subject to "waterspouts," and we have had the problem of constructing permanent crossings over channels which normally carry little or no water, and yet, once in four or five years, carry a large volume which brings with it large quantities of gravel, sand, dirt, sagebrush, and in some cases large boulders. It is obvious that to provide a bridge for this large volume of water would entail considerable expense, and, as channels of this nature are frequently encountered, it was apparent that some other type of structure must be found. Small culverts capable of carrying the normal run-off would become clogged with debris during a cloudburst, and, if the road were on a fill, it would be washed out. We have therefore adopted as part of the standards of construction "concrete" and "gravel-surfaced" dips. The road is constructed directly on the bottom of the watercourse and between the points of extreme high water a compact surface of gravel or concrete is provided which is held in place by concrete walls set in the channel bed. This type of crossing is safe, easy riding, and permanent, has a comparatively low cost, and can be easily maintained.

In the construction of projects, existing bridges and culverts have been utilized whenever it was possible and feasible to do so. Some times existing structures have been removed and new ones built, because in improving the alinement or grade of a road the existing structure would not fit the new conditions. Such changes have been made only when it was felt that the additional expense of building a new structure was warranted by the improvement in the road. By far the majority of structures that have been removed and rebuilt were entirely inadequate for the traffic, or were in such poor condition that it was a matter of only a short time until they would require replacement. A large number of small wooden culverts, more or less deteriorated, have been torn out, and permanent concrete or corrugated-iron culverts built in their place.

For all pipe culverts, box culverts, and bridges having a clear span of twenty feet or less, standard plans were prepared which show in detail the method of construction. This assures us of securing a uniformity of construction over the entire State.

All bridges and drainage structures have been designed to carry, in addition to their own weight, a moving load equivalent to a fifteen-ton truck for roadways sixteen feet in width or less, and two such trucks for roadways exceeding sixteen feet in width. Impact has been considered as 30% of the moving load. This seems to be a fair prediction of future traffic. Six-ton trucks are now frequently encountered, which,

with their own weight, means about a 10-ton load. Slow-moving vehicles, such as tractors, have a much smaller impact effect, so that a 20-ton tractor is considered as equivalent to a 15-ton truck.

For bridges having a clear span in excess of twenty feet, the local conditions of the stream-channel and foundation material vary to such an extent that it was thought advisable to treat each structure as a special case.

In 1918 plans were prepared for four special bridges, but, before construction could be started, and, in fact, after bids on one of these projects had been opened, advice was received from the National Highway Council that construction should be postponed. The cessation of war activities enabled us to proceed with these contracts in 1919, and the bridges are now completed and in service. The bridges referred to are the first four described in the following paragraphs.

During the past two years the following bridges, having a clear span in excess of twenty feet, have been completed or are now under construction:

Project No. 1—A reinforced concrete-pile trestle 144 feet long with a roadway 18 feet wide, over the Humboldt River at a point $4\frac{1}{2}$ miles east of Lovelock, completed December, 1919. This bridge, located on the road from Lovelock to Winnemucca, replaces a wooden structure on the old county road which crossed the river at a point about half a mile upstream. The construction of the bridge and one mile of road shortened the distance from Lovelock to Oreana about one mile.

Project No. 2—A reinforced concrete girder bridge 90 feet long with a roadway 18 feet wide over the main canal of the Newlands Irrigation Project, about $1\frac{1}{2}$ miles west of Fallon, completed November, 1919.

Project No. 3—A reinforced concrete-pile trestle 162 feet long with a roadway 18 feet wide over the Carson River about two miles west of Fallon, completed October, 1919. By locating the highway on the south side of the Southern Pacific Railroad two grade-crossings used by the existing county road were eliminated. The existing bridges on the county road over the canal and river were inadequate for heavy traffic—in fact, the river bridge had to be strengthened in order to carry ordinary traffic until Project No. 3 could be completed.

Project No. 8-B—A reinforced concrete-arch bridge of 80 feet clear span and with a roadway 18 feet wide over the West Walker River at Bulkhead, 15 miles southerly from Yerington, completed May, 1920. This bridge in connection with road Projects 8-A and 8-C opened a new avenue for traffic between the Smith and Mason Valleys over a road with easy grades and no high summits, and shortened the distance from Wellington to Yerington about 12 miles.

Project No. 9-B—A reinforced concrete-arch bridge of 35 feet clear span and with a roadway 24 feet wide over Dry Creek, 4 miles south of Reno, on the South Virginia road, completed November, 1920. This bridge replaced a small steel-truss bridge, the members of which were carefully investigated and found to be heavily overstrained for loads then passing over that section of road. Members of the old steel bridge were bent, and the trusses showed a perceptible sag, due to the heavy loads being carried, and it was only a question of time until failure of this structure under some unusual load would cause heavy damage and possibly loss of life. The State was building a road 24 feet wide with

an 18-foot pavement along this section, which would greatly increase the amount of speed of traffic and weight of loads hauled, and the old bridge, being narrow and inadequate as to strength, was considered highly dangerous. When the old bridge was removed it was found that the constant vibration of the structure under loads had practically disintegrated the concrete floor; also it was originally intended that a portion of the north abutment of this bridge would be used in the new structure, but excavation during construction showed a pocket of gravel and sand masquerading as concrete and extending the length of the wall, which made it necessary to replace the wall with new concrete. Included in the construction of this bridge was 115 linear feet of rock wall, necessary to protect adjacent property from stream-wash, which was the consideration for securing additional right of way necessary for the bridge and adjacent road. By locating the new bridge about ten feet east of the old, the alinement of the road was straightened, eliminating two curves which, although of minor consideration, is worthy of mention.

Project No. 22—A steel-truss bridge of 126 feet span and with a roadway 18 feet wide over the Humboldt River near Dunphy, Eureka County, completed December, 1920. This bridge, together with the construction of $2\frac{1}{2}$ miles of new road to be built next spring will route the travel from Battle Mountain to Carlin out of Battle Mountain south of the Southern Pacific Railroad to Shoshone Point, thence across the railroad, river, and bottom lands to a connection with the existing road to Carlin beyond the White House ranch. This new location of the road will eliminate the Boulder Flat, which is undoubtedly the worst stretch of road on the entire northern route across the State.

Project No. 27—A bridge 750 feet long, composed of two steel-truss spans of 126 feet each and the remainder of timber-pile trestle, all with a roadway 16 feet wide. This bridge now being constructed over the Virgin River in Clark County, between Bunkerville and Mesquite, is on the main highway between Utah, southeastern Nevada, and southern California. At present traffic must ford the river at this point, and a team is maintained by Clark County at the crossing to haul vehicles across the river. Frequently the river cannot be forded on account of high water, and traffic is forced to wait until the river recedes.

Project No. 35—A timber-truss bridge 110 feet long with a roadway 16 feet wide over the Muddy River at St. Thomas, Clark County, for which bids are now advertised, will be constructed this winter. A timber bridge is being built here to replace an existing timber structure, which is in an extremely weakened condition due to washouts. The Muddy River, a channel eroded thirty feet deep in the last ten years by waterspouts, has not yet reached a stable condition, and, were a concrete or steel bridge erected here, we might find it rendered entirely useless by further erosion or an entire shift of the river channel.

Along the abandoned grade of the Las Vegas and Tonopah Railroad, between Las Vegas and Beatty, numerous railroad trestles were refloored for highway traffic at a comparatively small cost. The fact that the bents and stringers were in place, and in most cases in excellent condition, and the lumber for flooring was immediately at hand in the ties of the old railroad, effected a large saving to the State on this road.

Material and labor shortage in 1919 caused progress in construction to be rather slow, and during 1920 the labor condition was not a great

deal improved. As this year draws to a close the indications are that the construction program for 1921 will not be so seriously hampered by the labor and material market.



Reinforced Concrete Pile Trestle over Carson River near Fallon—
137-foot span. Built under Contract 3, Project 3.



Reinforced Concrete Pile Trestle near Lovelock—137-foot span.
Built under Contract 1, Project 1.

THE LAHONTAN PLANT

"The Lahontan Plant" was constructed in the early part of 1920 for the purpose of furnishing sand and gravel for the various paving operations in the vicinity of Reno and Carson City, as well as some materials for concrete structures within a territory permitting freight haul.

Notwithstanding the fact that Nevada is probably the most mountainous of all the States, and there appears to be an ample supply of rock and sand everywhere, it is a fact that there are very few materials of this character which are suitable for highway construction, so that the supplying of these materials has been one of the greatest concern to this department.

At the time the program for the construction of permanent roads in the vicinity of Reno was worked out, it was ascertained that an enormous quantity of material need be furnished from sources which were not developed. The Reno-Carson City road alone required upwards of 7,000 carloads of material. There were no plants in or near the State capable of supplying any of this material, and in this respect we were very unfortunate and unlike other States where large commercial sand, gravel, and rock plants were in existence and in operation.

Certain definite standards for all of the material to be used in these roads were included in the specifications and approved by the federal authorities. These standards were as lenient as we deemed it possible to make them and yet secure a finished roadway of the most durable type.

A material survey of the entire vicinity of Reno was made by members of this department, with the result that very little rock suitably situated met our requirements and no sand except one small pit situated about two miles southwest of Reno. This material survey, aside from the physical examination of the various deposits of material, consisted of a great number of laboratory tests—over seventy-five tests of sand alone being made.

In the early part of 1919 an endeavor was made to contract the furnishing of crushed rock to this department from a rock deposit twelve miles east of Reno which had been acquired by this department at a nominal expense. At first we were unsuccessful in this, but, as a result of continued effort in the way of advertisements, we finally entered into a contract in the latter part of July of that year with Ward Brothers by which they agreed to furnish us 30,000 tons of this material. A plant was constructed by them, but was entirely unsuited to the requirements of the contract, and, after furnishing to us in a desultory manner a small part of the material contracted for, they went into bankruptcy. After failure on our part to make a satisfactory arrangement with the bondsmen to continue the operation of the plant, and because of the inability of the plant to produce material at anything like a reasonable cost, the proposition to obtain more material from Hafed was abandoned.

During the season of 1919 crushed rock was obtained from Hafed, and sand from the Mongolo Pit, southwest of Reno. The supply from these two sources was just about sufficient to meet our requirements for that season; however, we were forced to borrow from the city of Reno about 1,800 tons of material, which was returned during the 1920 season from the Lahontan plant.

After exhausting the supply of sand from the Mongolo Pit and the failure of the contractors to provide crushed rock from Hafed, we were forced to consider other steps to secure material for the 1920 construction. In the early part of the spring of 1920 and after every other means was found unfeasible, the State Highway Engineer was instructed to proceed with the construction of a sand-and-gravel plant at Lahontan, about 65 miles by rail from Reno. The supply at that point is located on the shore line of the Lahontan reservoir, and is the result of the formation of a delta in prehistoric times. The Lahontan Dam was constructed of this material, and considerable information was available to us from explorations made by the Reclamation Service at that time, so that we were sure of material that more than met our requirements as to quality, and for purposes of our road construction the supply was inexhaustible.

The material would, after passing through a properly designed plant, supply us with both sand and gravel, but not in the proportions which we desired, in that the proportion of sand would be such as to give us an excess of that material. The State Highway Engineer interviewed in California several of the concerns engaged in producing sand, gravel, and rock, and found the men who had designed most of the plants on the Pacific Coast. Arrangements were made with them to view the site at Lahontan and design the plant; construction work started with the design.

The plant had to be specially designed for the particular material at hand, and consequently consists of some novel features. The plant is so arranged that the gravel is divided into three separate sizes and then remixed into a gravel for concrete construction. This has been found necessary in all parts of the country in order to secure gravel that will make the concrete of the required density, and consequently the most durable. After the gravel is separated from the material, sand is obtained by a washing process. Five bins constitute the superstructure, the first bin receiving the gravel which is in excess of $2\frac{1}{2}$ inches in diameter and is called the "oversize bin." One bin receives the gravel in sizes from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches; another from $\frac{3}{4}$ to $1\frac{1}{2}$ inches; another from $\frac{3}{8}$ to $\frac{3}{4}$ of an inch; the last being the sand bin. The bins altogether have a capacity of about twelve carloads of material.

The oversize rock obtained in the first bin is run through a crusher and redelivered at the top of the plant and distributed to the various bins other than the one from which it came.

The three sizes of gravel are mixed in their proper proportion by means of a belt conveyor operating in a beltlike fashion from the back of the plant to the cars into which the material is loaded for shipment.

Water for washing the material is obtained from the Lahontan Reservoir, to which a large pipe-line was constructed. Electric power was obtained with which to run the plant itself, the pumps, and to give light. The plant was designed for a capacity of 700 tons in eight hours.

In the construction of this plant and its operation there has been a multiplicity of difficulties and hindrances. The machinery could not be purchased in the open market, and all had to be specially manufactured at a time when material and labor were very difficult to secure by concerns engaged in that business; the matter of securing competent labor with which to construct the plant was very difficult, and

climatic conditions at the site were such as to lend discouragement to any sort of effort by those in charge of the construction. The fact that contracts had already been awarded requiring some of this material made it urgent and imperative that the construction of this plant be completed at the earliest possible date in order to avoid delays in the



paving program for 1920, and this in no small degree had a tendency to make the construction rather costly.

Fortunately the Tonopah branch of the Southern Pacific was only about half a mile from the location of the plant, and it appeared rather easy to install the spur-track, but the requirements of that company were such as to make that installation rather difficult. Notwithstanding their requirements and the difficulties of the situation, the track as installed affords ample car storage and ease of switching. The part of

the switch passing the loading chutes is made in such a manner that the cars can be operated by gravity. The total cost of the plant, excluding the spur-track, but including everything else, such as pumps, hoists, track lines, etc., was \$64,875.82, and originally paid for out of the State Highway Fund. The financing of this undertaking was such, however, that within a period of two years after July 1, 1920, the Federal Government contributed a portion of 50% of the original cost of the plant, and the State contributed the balance of 50%. The material was furnished by the State in the manner probably 35% of the total cost, and the balance was paid in the manner in which funds are usually placed at the disposal of the State. These plans of amendment were agreed upon, first, by a committee of the State Highway Department, and, second, as a condition of the loan, by the Federal Government. The cost of construction was \$64,875.82.

The plant meets our existing needs, but it is doubtful if it will meet the conditions. It is doubtful if it will operate the plant through the utmost of the plant through the shortage of our pumps. It is also at the expense of the pump from the midst of the so that it becomes a trouble, other caterpillar, ample power, fact that the designed, and a great deal.

During the year of 21,601.46, approximately 5,000 tons of material were shipped. It is contemplated during the winter months for work in the season of 1921.

THE

DE

In the fall of 1920, the Clark County Highway Commission decided to reconstruct the road between Las Vegas in Clark County and Beatty, Nevada, and to place its track. It was observed by some of the far-seeing citizens of Las Vegas that this roadbed, if reconstructed, would make an excellent highway between the extreme southern part of the State and Beatty, and particularly was this desirable, for the reason that the existing highway between those points was in a deplorable condition and was almost impassable at certain seasons of the year.

The territory between Las Vegas and Beatty consists, for almost the entire distance between those points, of an uninhabited desert region,

and, to one unacquainted with its peculiar conditions, very dangerous, so the obtaining of a good highway was not only desirable to provide the comforts of travel, but to act as a protection to those unfamiliar with the region and yet forced to travel it.

The Highway Department was unable to negotiate with the railroad company for the acquisition of this roadbed until it had been designated as a part of our State Highway System. This was done in the early part of the legislative session of 1919. The Highway Department immediately thereafter instructed the Highway Engineer to negotiate with the railroad company for the acquisition of this railroad grade and such of the roadbed structures as might be of advantage to it in reconstructing the grade into a highway. After some negotiation an agreement was entered into with the railroad company whereby, for the consideration of \$3,889.44, the State acquired a quit-claim deed to all of the right of way, a title to all of the bridges which had not theretofore been dismantled, and various other structures, including two wells which might be considered of value to the department. The length of the line involved is 120 miles, so that the value of the grade obtained is, on account of the grade work already done and the bridges installed, many times the price paid for it.

The grade, as left by the railroad company, presented a discouraging appearance in that practically all of the ties were left in place and but little maintenance work had been done upon it during the last few years by the railroad company.

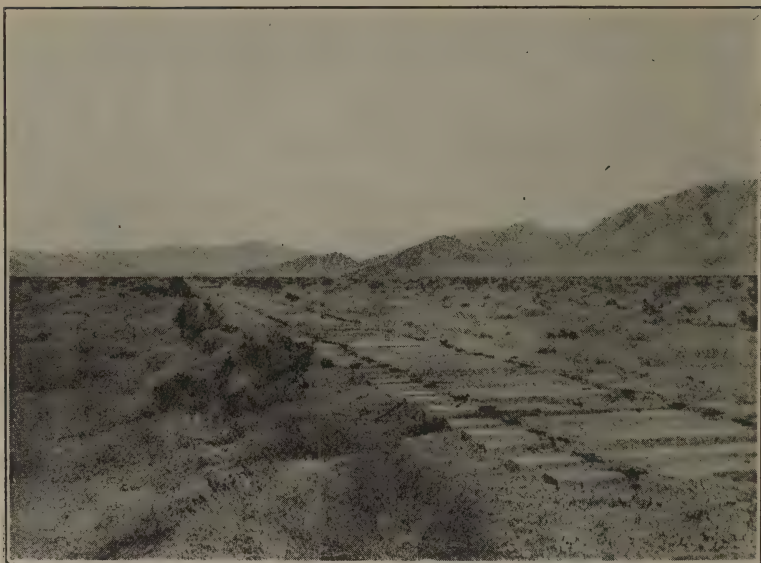
On account of climatic conditions existing in this territory, it is not feasible to do work at any other period of the year than during the winter months.

Following the legislative Act making the acquisition of this grade possible, a very short working period remained in the spring of 1919. Nevertheless, an attempt of a preliminary nature was made for the purpose of determining the best method and equipment needed for performing the work.

During the winter of 1919-1920 considerable work was done on the entire grade from Las Vegas to Beatty, which accomplished the removal of all the ties, the reconstruction of all the bridges which had been left by the railroad company, and the building of other bridges where they had been torn out. The work also consisted of the dragging of the road from one end to the other by a heavy drag so as to remove practically all of the "tie marks." This was all that was possible to do in that season and under the conditions existing at that time. This at once made available for traffic practically the whole of the grade and permitted the department, during the season of 1920, to observe what was necessary to be done in order to make this a first-class highway.

It had first been determined that the work could best be handled by doing it by day-labor forces rather than by contract, for the reason that conditions which might be met by the contractor cannot very well be anticipated and accordingly intelligent specifications written, and this is the reason, probably more than any other, that we desire the State Highway Act so amended at the next session of the Legislature as to permit of the doing of work in this manner.

Along with the acquisition of the railroad grade, we secured all of the original surveys of the railroad company, and have made arrangements with the Federal Government so that no additional surveys of



The L. V. & T. grade after removal of the steel rails. This is the condition of the grade when taken over by the State early in 1919.



Widening of the L. V. & T. grade by the State Highway Department. Grade was cut down 8 to 12 inches and widened to 16 feet.

consequence will be necessary before commencement of construction, and in this respect the purchase price of the railroad grade has been more than saved.

A complete study has been made of the various sections of this grade, so that, as soon as we are authorized to do the work by the proper legislation, we are prepared to improve this entire stretch of road by surfacing the bad sections with gravel, and next year it will be a highway equal to any other section of the State Highway System of the same length.

For all of this, federal aid is obtainable and the arrangements have been worked out whereby no delays will be occasioned by the necessity of presenting formal application for it to the Federal Government.

PROPOSED NATIONAL LEGISLATION

Since such a great incentive is given to the Federal Government by the financial assistance of the Federal Government, it is not surprising that the Federal Government is interested in the legislation enacted by Congress, and that it is interested to us, or of any other legislation in any other State, in highway affairs of this State.

When the department was organized we found that the conditions existing in the State, the Federal Government can assist us in a larger way than there is any other State. It holds the unique position of being a sort of a bridge between the East and West, and we believe the East and West can make their own connections across our State. It is not associated, but, nevertheless, it is a fact, that the Federal Government has appropriated public lands of the United States in the State of Nevada, and those public lands cover the entire area of our State. These lands are not owned by the State, but they are a source of revenue to the State. The entire administration of their affairs, except the matter of police regulation, rests in the hands of the federal authorities. We believe it to be a duty of the Federal Government in some manner to care for road construction and maintenance across these vast areas; and we further feel that it is an obligation upon the part of the Federal Government. This is accentuated somewhat by the fact that the small percentage of privately owned land is mostly concentrated in one or two highly productive sections of the State, leaving the major portion of our area practically all government lands.

The feeling of the members of this department that adequate recognition should be made of these accounts was presented to the federal authorities more than two years ago, and an endeavor has since been made by those in authority in Washington, by the American Association of State Highway Officials, and by various other organizations to have appropriate legislation enacted by Congress to change the proportion of federal aid money to this State in such a manner that some recognition would be given. Success has not followed these efforts as yet; however, at the last session of Congress a great amount of discussion was had of various bills which were introduced having this as their object. It is noteworthy in this connection that the platform of each of the two great political parties makes mention of the necessity of such legislation and both endorse it.

Within a very short time, and possibly at the next session of Congress,

there will be enacted new highway legislation with appropriations greater than any heretofore made. This legislation will undoubtedly be of one or two characters: first, the amendment and extension of the present Federal Aid Road Act, and, second, the creation of a Federal Highway Commission and the establishment of a National Highway System.

It is difficult for us to determine just which one of these measures would be of the greater benefit to our State, and we are watching with considerable patience the trend of opinion toward each of them, and suggesting, wherever possible, additions or amendments that would ultimately make either of them more beneficial to us.

Only a brief statement of the aims and purposes of these measures will be made in this report.

The extension of the Federal Aid Road Act would provide a much larger amount of money for the continuance of road construction on a cooperative basis with the Federal Government, the work on their part to be handled by the present Bureau of Public Roads, which is a part of the Department of Agriculture.

The Townsend bill provides for the creation of a Federal Highway Commission similar in authority and function to the Isthmian Canal Commission charged with the construction of the Panama Canal; and the designation, construction, and maintenance of a National Highway

System, a part of which would be located through Nevada, probably to consist of one road east and west across the State and one road north and south.

In the event of the passage of the Townsend bill, we would be relieved of the construction and maintenance of two transstate roads, and the Government would concentrate all of its energies toward the construction and maintenance of such roads, thus requiring but very little on the part of the State, which would be asked to furnish all necessary rights of way to the Government.

PROPOSED NEW STATE LEGISLATION

With the completion of the construction of a part of our State Highway System, and particularly since that has been done during a period of very adverse conditions of every nature, it has developed that a more efficient and satisfactory carrying on of the work can be had by certain changes in our present State Highway Act, and the department would suggest that very careful consideration be given to the following recommendations:

It is apparent, if state highway construction in Nevada is to continue with the same rapidity as federal aid money becomes available, that considerable thought must be given to the matter of financing the work on the part of the State and the various counties. We are opposed to long-term bond issues redeemed by direct taxation, except where no

other method can be provided. We desire at this time to keep to a minimum the direct tax on property, and suggest, in lieu of this, that more consideration be given to the licensing of automobiles and trucks, and especially a special license fee imposed upon those automobiles and motor trucks acting as public carriers. This last is deemed necessary, for the reason that in this manner taxes can be imposed upon those carriers that are comparable in some degree to the taxes paid by other transportation companies, such as railroads, and also to derive from them a fund with which to maintain the roadbed they are constantly using, and thus again making their service comparable to other transportation companies who are required to maintain their own roadbed.

Another source of revenue for state highway purposes is that form of a consumer's tax which collects an excise tax on the sale of gasoline. This is comparatively a new form of taxation, but where it has been tried out it is considered with much favor. Its particular advantages are that the one who uses the road most is required to pay the most for its upkeep, and it derives a revenue from the tourists who traverse the roads of our State, but live elsewhere.

Other means of revenue may be devised by the Legislature for the purpose of replenishing the State Highway Fund directly or as a means of retiring bond issues. Within the next two years, and before the Legislature convenes again, it will be necessary for the Highway Department to enter in certain cooperative agreements with the Secretary of Agriculture in order to retain certain additional federal money in this State amounting to \$2,276,992.29, which has been allotted to it; and one of the necessities of being able to enter into such agreements is that an equal amount of state and county funds be available with which to meet the requirements of the Federal Aid Act.

Another suggestion of your Highway Department is that in some manner the State Highway Act be amended so that a closer cooperation both in the financing and actual doing of the work be had with the several counties. This is deemed advisable in order that those people who more directly assist in the financing of the work might have more of a voice in its expenditure.

The Federal Aid Road Act provides a basis of cooperation between the Federal Government and the several States, and in that respect it has been found to be a success, and, on the basis of the same proposition governing that success, we believe careful consideration should be given to a closer cooperation with the various counties, probably to the point of each county having its own engineer, subject, of course, to the approval and sufferance of the Highway Department. There are many limitations to such an idea, principally defined by the requirements and regulations of the Federal Aid Road Act.

The highway law, in so far as it pertains to the condemnation of property for rights of way, should be amended in such a manner that there is no doubt of the right of the department to acquire property in this manner, and, particularly, obtain immediate possession once it decides that it is necessary.

At present a limitation is placed upon the department as to the amount of construction work which can be done other than by contract. During the existence of this department a multiplicity of adverse conditions have discouraged contractors in bidding, so that in a great many cases we have not received any bids in response to our advertisements.

It has not always been due to the scarcity of contractors, nor has it been attributed to their inability to do work in this State, but can be traced to their inability to provide ample finances with which to carry on the work; their inability to foresee labor conditions, and to the fact that much of the work contemplated to be done is surrounded by conditions of more or less unknown definiteness, such as deposits of material for gravel surfacing and concrete structures. Ofttimes but one bid has been received in response to our advertising, and there is a great deal of hesitancy on the part of the department to award contracts under such conditions, for the very reason that such a bid does not show competition. The following table will show this condition in a condensed manner:

	<i>Number</i>	<i>Percentage</i>
Times advertisements made and no bids received.....	3	5.8
Times advertisements made and one bid received.....	11	21.2
Times advertisements made and two or more bids received.....	38	73.0



View of Portion of State Highway through Wilson Canyon
in Lyon County.

There are certain classes of work which can be done to better advantage to the public by direct day-labor work than through a contractor's organization, and particularly is this true of the reconstruction of the old L. V. & T. R. R. grade in southern Nevada, where the uncertainties surrounding the doing of the work are such as to almost preclude their intelligent anticipation for the purpose of writing specifications and making advertisements for competitive bidding.

There have been cases where the contractor, for some reason or other, has not been able to complete his work or has been doing it in such an unsatisfactory manner that it is necessary for the State to do it in order to secure a completed project satisfactory to not only ourselves but to the Federal Government, and in such cases it is necessary for the State to complete the work by day-labor organization. For these reasons we believe that the Highway Act should be so amended as to give the Highway Department authority in its discretion to do work in this manner.

The department, as a general proposition, does not approve of the extension of the State Highway System, for the reason that the task outlined by the designation of the present system is sufficient to occupy the energy of the department for some time to come. The department will, however, lend its approval to the obtaining of federal aid by any county for any road project within its confines on which federal aid may be secured. Such projects must be financed by the county to the extent of that portion of the cost not obtainable from the Federal Government.

THE PROPOSED \$450,000 DONATION OF NORTHERN CALIFORNIA

The Overland Trail Club was organized in the early part of 1917 and is purely a Nevada organization. Its object is to secure an early improvement of the road traversing the northern part of the State through the cities of Elko, Carlin, Battle Mountain, Winnemucca, Lovelock and Reno, which route has since been designated as State Highway No. 1.

the
the
loc
ma
(
of
Re
me
tion
to
and
to
old
roa
V
into
me
wh
have concluded that the lending of financial assistance to an improved road across Nevada would best serve their purpose, and considerable effort has been made to raise the funds with which to assist the State of Nevada in the early improvement of one highway.

Northern California people, after their own investigation, selected the Overland Trail as the highway to which they would lend their financial aid, should any such aid be available. Since that selection, and all during the period of effort on the part of the northern California interests, Mr. Goodin and the Overland Trail Club have been quite active in the effort to cooperate both in a financial way and to the more early securing of money which might be given their road.

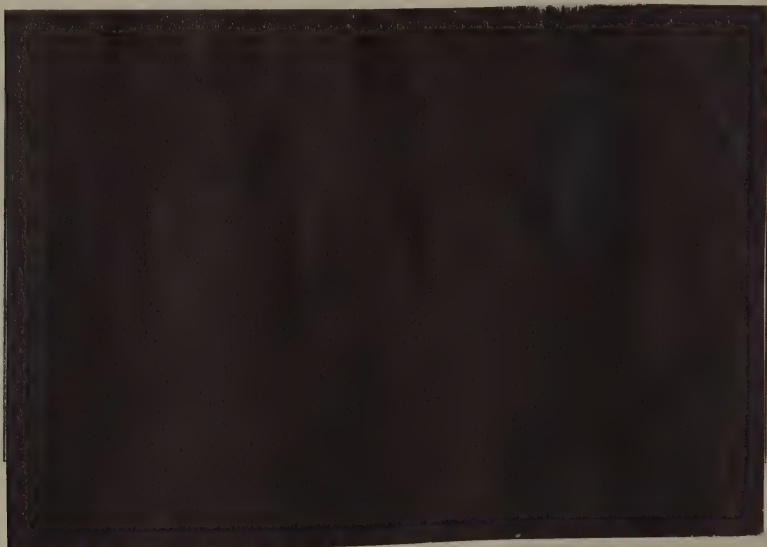
The understanding between the Overland Trail Club and California was that northern California would contribute \$450,000, providing the northern counties through Nevada would contribute a like sum by bond issues, it being understood that the total of these two amounts would be used for the obtaining of federal aid. At the last session of the Legislature provision was made by that body for the authorizing of the

various counties through which this road passed to issue bonds in a total sum of \$450,000, providing California was able to keep its promise.

Within the past two years many meetings have been held in northern California, having for their object plans for the raising of this large sum of money, but due to various causes it has not yet been made available to the Highway Department nor is it understood that any portion of it has been obtained by the California interests.

Reports coming to us indicate that the people of northern California who are interested in this project of financial assistance for the Overland Trail are still quite enthusiastic about it, and that they are still endeavoring to find ways and means of raising the money.

It is very probable, therefore, that at the next session of the Legislature the Overland Trail Club and the northern California interests will have devised some definite plan whereby it will be deemed necessary by the Overland Trail Club that authorizations be given to the



various counties in northern Nevada to meet their share of this agreement, should the pledge of the northern California interests be kept.

The bond-issue authorizations provided at the last session of the Legislature for the purpose of meeting the contribution of northern California interests have all expired by limitation.

LINCOLN HIGHWAY DONATIONS

The Lincoln Highway Association was one of the first organizations of the country to designate a transcontinental highway, and ever since the inception of the organization it has made an admirable fight for its early improvement. Too much cannot be said of the energy and unselfish spirit displayed by the founders of this organization in attaining an improved and connected road from the Atlantic seaboard to the Pacific Coast. True it is that many in different sections of the country have differed with the ideas of this association in the way of location, and what is true of other sections of the country is likewise the case in Nevada.

Through this State they designated as a portion of the Lincoln Highway what has since been designated by our Legislature as Route 2 of the State Highway System, being that route passing through Ely, Eureka, Austin, Fallon, and Reno, and they have concentrated their efforts upon this route with a tenacity of purpose that cannot help but call forth the admiration of those who might disagree with their ideas of location.

The efforts of the association include a raising of funds by voluntary contributions from eastern people to assist in the early improvement of sections of this highway across those areas of the country where finances would otherwise preclude the doing of the work, and thus, in no small degree, they take the function that we believe should belong to the Federal Government, on account of the enormous area of publicly owned lands.

Previous to last year much had been said of the funds which this organization had available for the State of Nevada, but nothing tangible had been received and no definite arrangements had been made toward securing them. In July of 1919, and after considerable correspondence had passed between the members of this department and the association, the State Highway Engineer was instructed to confer with the various officials of the Lincoln Highway Association in Detroit, Mich., and Akron, Ohio. As a result of these conferences the sum of \$120,000 was made available to this State for assistance in the improvement of specific projects on the Lincoln Highway, the details of which are later mentioned in this chapter.

The General Motors Company, through Mr. W. C. Durant, its president, contributed to the Lincoln Highway Association \$100,000 of this fund and the Willys-Overland Company \$20,000.

The Lincoln Highway Association, in contributing this money to the State, was desirous of securing an early completion of those sections of the Lincoln Highway which were then in a poor condition, and, as a consequence, certain definite agreements were made pertaining to the improvement of certain specific sections.

The money obtained from the Lincoln Highway Association would not of itself permit of the improvement of those sections along the lines desired by this department, but with state money, county funds, and that which could be obtained from the Federal Government, would materially assist and be a spur to their early improvement.

The projects which were enumerated by the Lincoln Highway Association and for which agreements have been entered into between the association and this department are as follows:

(1) Churchill County—The road across the Fallon Sink, being between Grimes Ranch and Sand Springs, a distance of approximately 17.3 miles; donated by the Lincoln Highway Association, \$45,500.

(2) Churchill County—The Mud Flats immediately east of Frenchman's Station, from a point $1\frac{1}{2}$ miles west of Frenchman's Station to a point $3\frac{1}{2}$ miles east thereof; Lincoln Highway funds, \$10,000.

(3) Churchill County—Between Eastgate and Westgate, approximately 15 miles; funds provided by the Lincoln Highway Association, \$7,500.

(4) Eureka County—Between Eureka and Hay Ranch, a distance of about 12 miles; Lincoln Highway Association, \$7,500.

(5) White Pine County—From Moorman's Ranch to a point 22 miles west thereof via Little Antelope Summit; \$7,500 provided by the Lincoln Highway Association.

(6) Churchill and Lander Counties—Between Eastgate and Austin, a distance of approximately 78 miles; contributed by the Lincoln Highway Association, \$42,000.

At the time of the conference with the Lincoln Highway officials definite information was had of the first five of these projects, and, in accordance with an understanding reached, the money made available for the improvement of them was deposited in Nevada banks, obtainable by the department as the construction work proceeded; \$78,000 was made available immediately, of which \$16,380 has actually been obtained by the department on account of construction heretofore accomplished.

At the time of the conference information was not available as to the proper location of the state highway between Eastgate and Austin, as the department had not then had an opportunity to investigate this territory with any sort of thoroughness. The association did, however, agree that upon the designation of this route by the engineers of the Highway Department the money would be made forthcoming. Since that time quite a thorough reconnaissance has been made of the territory, not only by the officials of the Lincoln Highway Association, but by engineers of the Federal Government and this department. As a result of this, the Lincoln Highway Association has informed us by letter that it is agreeable to depositing the money as for the other projects should we select the route via Newpass or Carol Summit, but that it did not look with favor upon the routes which have been investigated via Burnt Cabin Summit or the Upper Reese River Valley.

In the chapters pertaining to the various counties, mention is made of each of the above projects in detail. Suffice it to say here that, on account of unavoidable delays, the high prices surrounding the doing of work during this last biennial period, and the prohibiting of the doing of work by other than contract, we have been unable to do as much of this construction as was first contemplated. A considerable part of the work to be done across the Fallon Sink has been finished, and in a manner bringing forth the highest praise from the officials of the Lincoln Highway Association. Advertisements were made of the Eureka-Hay Ranch project, but without success; other projects have been surveyed and approved by the Federal Government.

Certain definite time-limits were included in the agreements with the Lincoln Highway Association, but the officials of that organization have indicated their willingness to extend the limits in order that the aid may be forthcoming during the next season.

Too much praise cannot be given to the officials of the Lincoln Highway Association by the people of this State, not only for their magnanimity of spirit, but for the enthusiasm with which they have made this contribution and with which they have entered into the working out of the many details involved in the proposed construction.

White Pine County.....4,554.00
 Total placed in escrow with Carson Valley Bank..... \$78,000.00

ADDITIONAL DEPOSIT TO BE MADE

6. Eastgate to Austin, Churchill and Lander Counties..... 42,000.00
 Total donation of Lincoln Highway Association.....\$120,000.00
 Payments made to State during 1920..... 16,380.00
 Available balance of donation.....\$103,620.00



Dragline Excavator making the fill across the Fallon Sink.
Contract 17, Project 24.



THE CENTRAL MIXING PLANT



Loading the Aggregate from Stock Pile into Mixing Bins of Plant.



Filling the Batch Compartment Trucks with Mixed Aggregate
at the Mixing Plant.



Dumping the Mixed Aggregate from Truck into Hopper of Concrete Mixer.



Dumping the Dry-Mixed Aggregate into the Mixing Drum.



Spreading and Tamping the Poured Concrete.



Rolling the Pavement with the Mason Squeegee Roller Immediately after Pouring.



Finishing the Pavement Surface by the Belt Method



Curing of the Pavement During Set by the Ponding Method.



The Completed Pavement Opened to Traffic. Shoulders not yet completed.

TABULATION OF FEDERAL AID PROJECTS

<i>Proj. No.</i>	<i>Designation</i>	<i>Estimated cost</i>	<i>Federal share</i>	<i>Amount under agreement</i>
1.....	Persh. 1-C.....	\$124,018.08	\$62,009.04	\$60,234.49
2.....	Nye 4-A.....	44,120.44	22,060.22	22,060.22
3.....	Chur. 2-B.....	94,348.72	47,174.36	47,174.36
4.....	Doug. 3-B.....	19,949.60	9,974.80	4,942.85
5.....	Elko 1-A-1.....	98,066.56	49,033.28	49,033.28
6.....	White Pine 2-C-1..	75,603.79	37,801.89	31,923.10
7.....	Washoe 3-A-1.....	373,915.28	186,400.00	186,400.00
8.....	Lyon 3-C.....	70,532.51	35,266.25	35,266.25
9.....	Washoe 3-B.....	194,907.27	97,453.63	80,634.87
10.....	W. P. 2-C-2.....	94,000.50	47,000.25	
11.....	Esmer. 3-C-1.....	44,337.86	22,168.93	22,168.93
12.....	Lyon 3-D-1.....	25,609.29	12,804.64	12,804.64
13.....	Nye 4-D-1.....	40,700.00	20,350.00	
14.....	Doug. 3-C-1.....	44,063.65	22,031.82	15,146.45
15.....	Elko 1-A-2.....	42,269.15	21,134.57	21,134.57
16.....	Lander 1-A-1.....	28,454.80	14,227.40	14,227.40
17.....	Lyon 3-B-1.....	46,310.11	23,155.05	23,155.05
18.....	Elko 1-B.....	229,285.32	114,642.66	
19.....	Persh. 1-D.....	103,718.20	51,859.10	51,859.10
20.....	Doug. 3-B-1.....	11,734.58	5,867.29	
21.....	Washoe 1-B-1.....	42,407.07	19,400.00	19,400.00
22.....	Eureka 1-A-1.....	108,823.99	54,411.99	54,411.99
23.....	Mineral 3-E.....	202,269.65	101,134.82	91,678.95
24.....	Chur. 2-C-1.....	104,500.00	52,250.00	52,250.00
25.....	W. P. 2-C-2.....	8,255.22	4,127.61	4,127.61
26.....	Washoe 1-A-1.....	153,168.40	76,584.20	
27.....	Clark 6-G-1.....	87,407.10	43,703.55	43,703.55
28.....	Doug. 3-B-3.....	79,753.74	36,000.00	36,000.00
29.....	Washoe 3-A-2.....	456,589.68	209,400.00	207,457.64
30.....	Ormsby 3-C.....	138,370.67	69,185.33	63,088.59
31.....	Eureka 2-B.....	86,402.80	43,201.40	
32.....	Humboldt 1-D.....	68,530.00	34,265.00	
33.....	Lyon 3-B-2.....	82,955.29	41,477.64	
34.....	Chur. 1-A-1.....	121,148.80	60,574.40	
35.....	Clark 6-F-1.....	7,491.00	3,745.50	
36.....	Reno-Purdy.....	144,160.30	72,080.15	
37.....	Clark 6-E-1.....	80,589.74	40,294.87	
Totals.....		\$3,778,769.16	\$1,864,251.64	\$1,250,283.89

STATEMENT OF RECEIPTS

Class of income	1917-1918	1919	1920	Grand total revenue	Grand total refunds	Grand total receipts
Legislative appropriation				\$40,000.00		\$40,000.00
Taxes, net amount received	\$40,000.00			488,932.41		488,932.41
Taxes, Storey County (later refunded)	181,050.33	\$194,941.22	\$113,000.86	2,379.88		2,379.88
Taxes, Lincoln County (later refunded)		30,738.25		9,249.58		9,249.58
Automobile licenses	63,851.10	7,451.92	329.75	94,569.30		94,569.30
Racing Commission fees	17,024.99	10,000.00	20,055.18	44,532.09		44,532.09
Special deposit, Lyon County		50.00		10,000.00		10,000.00
Truck rentals			1,059.70	2,099.70		2,099.70
Lincoln Highway Association			16,380.00	16,380.00		16,380.00
Miscellaneous refunds	195.16	181.89	1,578.01		\$11,045.06	1,755.06
Sales of department property		48.94				48.94
Equipment refunded from counties		7,631.62	2,507.52	2,556.46		38,882.57
Rights of way proceeds		6,076.78	31,250.95			38,882.57
Construction refunds by counties		78,982.23	225,211.33		6,076.78	304,193.56
Construction refunds by Federal Government		125,570.65	335,906.73		511,477.38	511,477.38
State bonds issued and sold			475,000.00	475,000.00		475,000.00
Total receipts by year totals	\$302,121.58	\$473,302.96	\$1,281,930.03			
Grand total revenue				\$1,184,789.42		
Grand total of refunds					\$871,675.35	
Grand total of receipts						\$2,056,464.77

STATEMENT OF DISBURSEMENTS

Classification of disbursements	1917-1918	1919	1920	Grand total
<i>Asset Accounts</i>				
Contract payments and engineering on contracts-----	-----	\$345,882.71	\$863,138.49	\$1,209,021.20
Construction materials furnished by State-----	-----	45,011.81	293,914.98	278,926.80
Operation of contracts taken over by State-----	-----	-----	12,424.83	12,424.83
Construction payments under section 8, Federal Aid Act-----	-----	-----	50,905.76	50,905.76
Lafayette sand and gravel plant—Inventory value-----	-----	-----	52,363.06	52,363.06
Reno Material Yard—Inventory value-----	-----	-----	37,194.69	37,194.69
Reno Material Yard-----	-----	-----	3,718.90	3,718.90
Hated Quarry Plant-----	-----	1,415.03	3,028.17	4,443.20
Equipment inventory accounts-----	-----	47,680.90	28,863.52	107,504.51
Delivery costs of surplus materials-----	\$24,662.09	36,146.00	41,281.05	117,909.15
County tax refund (Section 31, Highway Law)-----	-----	11,629.46	-----	11,629.46
Accounts receivable—All sources-----	-----	16,113.58	-----	16,113.58
Reno plant operating account-----	-----	-----	48,204.89	48,204.89
Plans and estimates-----	28,506.20	30,930.13	46,124.46	105,560.79
Bridge layouts-----	5,663.15	6,711.76	44,573.64	109,097.97
Rights of way purchased-----	-----	6,711.76	7,485.98	14,197.74
Military information for Federal Government-----	1,905.27	9,853.02	7,564.89	19,323.18
State road map compilation-----	1,896.35	-----	-----	1,896.35
Maintenance expenditures-----	-----	100.34	926.40	1,026.74
General administration—Headquarters-----	16,595.54	29,330.21	44,121.16	90,047.91
General administration—Division No. 1, Las Vegas-----	33,083.06	38,222.73	51,316.39	112,622.18
General administration—Division No. 2, Reno-----	-----	-----	4,998.56	4,998.56
Revolving and emergency funds (transfers only)-----	2,500.00	7,500.00	2,912.37	12,912.37
Less credit regular entries (department transactions)-----	-----	-----	10,000.00	10,000.00
Less profit account Reno plant operation-----	-----	-----	-----	-----
Net total disbursements-----	\$114,312.66	\$627,363.72	\$1,553,986.75	\$2,296,163.13

TABLE SHOWING STATE CONTINGENT LIABILITY ON UNCOMPLETED CONTRACTS

County	Location				Estimated cost pay-ments to complete present contracts	Distribution of liability costs		
	Route	Section	Contract No.	Project No.		Estimated federal share	Estimated county share	Estimated state share
Lyon	3	C	5	8-B	\$4,808.18	\$2,259.84	\$2,548.34	\$4,783.67
White Pine	2	C	7	6	19,194.67	9,567.33	14,783.67	14,783.67
Elko	1	A	8	5	49,321.12	20,714.88	14,308.12	14,308.12
Washoe	3	B	12	9	20,200.00	10,100.00	5,050.00	5,050.00
Washoe	3	A	14	7	2,000.00	1,000.00	1,000.00	1,000.00
Douglas	3	C	12	14	1,500.00	750.00	375.00	375.00
Churchill	2	B	16	3	9,325.52	4,196.48	2,564.52	2,564.52
Washoe	2	C	20	1	7,492.98	3,746.49	1,873.25	1,873.25
Pershing	1	E	22	23	110,592.31	55,266.15	23,843.73	23,843.73
Mineral	3	D	26	19	45,116.32	22,558.16	11,279.08	11,279.08
Pershing	1	A-1	28	7	199,157.78	99,578.89	69,705.22	69,705.22
Washoe	3	A-2	29	29	118,745.00	59,372.50	41,560.75	41,560.75
Washoe	3	C	30	27	50,831.83	25,415.91	12,707.96	12,707.96
Clark	6	G	34	12	6,682.62	3,341.31	1,670.65	1,670.65
Lyon	3	D	35	22	4,194.54	2,097.27	1,048.63	1,048.63
Eureka	1	A	35	22	23,549.79	9,890.91	11,309.50	11,309.50
Douglas	3	B	36	28	19,312.88	9,656.44	6,759.50	6,759.50
Washoe	3	A-2	37	29-B	22,845.20	11,422.60	5,711.30	5,711.30
Washoe	3	A-2	38	29 B	14,466.87	7,233.44	3,616.71	3,616.71
Douglas	3	C	39	14	7,491.00	3,745.50	1,872.75	1,872.75
Clark	6	F	40	35				
Grand totals					\$736,708.61	\$361,914.10	\$229,578.08	\$145,216.43

REPORT OF THE DEPARTMENT OF HIGHWAYS

69

CONSTRUCTION REIMBURSEMENTS AND AMOUNTS DUE STATE

Contract No.	Total cost payments to November 30, 1920	Federal Government		County participation		Financing by State	
		Status of federal payments		Status of county payments		Share of cost assessed to State	Now carried by State and due from government and counties
		Total federal share	Paid	Vouchered	Unvouchered		
1	\$13,288.91	\$6,540.25	\$5,073.23	\$1,466.97	\$3,322.23	\$3,374.30	\$1,519.10
2	7,051.75	3,884.70	2,831.23	336.82	1,833.46	1,833.50	553.56
3	14,013.59	6,625.77	5,144.28	926.84	3,643.54	3,643.87	1,581.90
4	29,626.98	11,734.35	11,372.63	361.82	10,940.11	10,926.79	3,751.14
5	7,819.01	3,674.93	5,431.81	5,876.39	1,326.90	2,817.58	1,060.30
6	49,531.88	24,765.65	18,889.56	5,876.39	12,382.97	12,382.96	5,876.39
7	61,849.87	27,832.42	22,397.81	5,434.61	16,626.29	16,798.42	6,027.35
8	68,791.36	28,892.39	27,514.98	1,377.41	21,183.59	18,715.38	1,377.41
9	53,280.93	26,640.46	18,131.62	8,508.84	13,320.26	13,820.21	10,128.07
10	30,146.82	14,243.60	14,227.40	16.20	8,093.43	1,455.63	7,809.79
11	54,260.82	25,502.56	18,103.22	7,399.34	13,990.63	537.33	21,867.30
12	133,719.63	95,710.77	63,332.60	21,471.41	46,796.48	46,454.63	38,135.92
13	46,448.94	19,400.00	10,906.76		5,757.75	27,048.94	
14	44,218.47	21,084.88	387.12	3,676.99	16,945.04	5,349.97	10,252.66
15	25,982.02	12,996.02	8,972.98	2,380.35	7,503.65	5,492.35	4,023.04
16	80,683.12	39,241.29	19,872.00	14,400.49	20,788.33	3,366.48	29,564.06
17	60,902.62	33,042.57	33,042.57	21,924.95	16,380.00	5,544.95	5,544.95
18	48,222.17	22,664.40	20,426.54	2,237.86	8,019.02	4,734.97	6,997.76
19	5,305.05	2,652.52	2,611.74	140.78	2,652.53		140.78
20	99,376.45	49,688.24	45,810.35	3,877.89	21,884.04	24,844.08	6,837.98
21	30,050.04	14,536.45	10,568.65	3,967.80	15,513.59	15,356.66	4,124.73
22	82,490.39	41,245.19	33,966.52	7,278.67	22,272.41	156.93	17,828.98
23	14,521.63	6,825.34	6,825.34	6,825.34	4,617.04	33.21	6,858.55
24	63,817.63	31,908.81	28,812.85	34.46	13,793.09	2,161.33	15,954.40
25	27,117.04	10,477.43	8,048.13	2,429.36	5,468.34	500.23	3,211.36
26	106,696.61	53,348.30	5,436.48	4,015.43	37,345.81	15,676.99	8,198.03
27	86,812.77	43,217.19	21,437.06	5,902.86	30,195.27	8,725.78	33,671.49
28	3,001.75	1,401.82	1,401.82	1,401.82	960.57	150.97	2,371.39
29	12,063.56	5,782.76	5,209.56	573.20	3,219.61	73.26	6,237.29
30	5,350.80	2,568.39	1,891.97	676.42	2,782.41	381.27	1,077.44
31	7,591.76	3,795.88	3,795.88	3,795.88	2,381.39	134.31	5,693.83
32	16,598.55	8,229.23	6,649.90	1,649.38	1,885.90	32.05	11,887.89
33	3,916.68	1,958.34	1,829.70	1,28.64	1,793.01	979.17	2,937.51
34	63,862.63	26,822.29	26,822.29	128.64	867.03	14,238.60	41,660.89
35	10,712.08	5,356.03	4,081.19	1,274.84	16,415.47	1,842.29	9,106.28
36	772.79	386.40		386.40		1,906.96	115.90
37							
38							
Section 8							
1-8	22,516.83						22,516.83
2-8	31,000.00						15,500.00
3-8	1,700.00						1,700.00
Totals	\$1,579,124.29	\$734,247.03	\$489,668.93	\$133,383.14	\$112,952.84	\$342,382.84	\$357,680.77
					\$51,012.36	\$87,535.99	\$389,391.75

*Lincoln Highway Association.

REPORT OF THE DEPARTMENT OF HIGHWAYS

CLASSIFIED CONSTRUCTION EXPENDITURES, 1919-1920

Cont. No.	Fed. Aid Project No.	Contractor	Payments to contractors	Engineering 10% fund costs	Materials furnished by State	Construction carried on by State	Total cost payments to Nov. 30, 1920
1	1	Parrott & Thompson.....	\$11,871.60	\$1,417.31	-----	-----	\$13,288.91
2	3	Parrott & Thompson.....	6,366.13	685.62	-----	-----	7,051.75
3	3	Parrott & Thompson.....	12,294.16	1,719.43	-----	-----	14,013.59
4	8-A	Niedt & Gavin.....	27,221.87	2,401.99	\$3.12	-----	29,626.98
5	5	Parrott & Thompson.....	5,848.71	1,970.30	-----	-----	7,819.01
6	6	E. S. Berney.....	44,448.72	5,083.16	-----	-----	49,531.88
7	2	Lincoln Construction Co.....	51,596.05	10,253.82	-----	-----	61,849.87
8	5	J. H. Rooney, et al.....	48,968.86	9,624.44	-----	-----	58,593.30
9	11	John O'Keefe.....	17,411.20	8,410.93	-----	-----	25,822.13
10	16	William Licking.....	27,981.14	2,165.68	-----	-----	30,146.82
11	8-C	Nevada Construction Co.....	49,143.20	5,113.62	-----	-----	54,256.82
12	2	Ward Bros.....	72,433.50	10,942.12	4.00	-----	83,375.62
13	21	Pacific States Construction Co.....	22,333.29	3,080.65	21,085.00	-----	46,448.94
14	7	Niedt & Gavin.....	37,913.24	6,305.23	-----	-----	44,218.47
15	14	Kibby & Gibson.....	14,684.08	4,043.12	-----	-----	18,727.20
16	3	Armstrong & Baker.....	41,338.64	6,252.84	33,091.64	-----	80,683.12
17	24	W. J. Schmidt.....	43,709.24	4,512.93	-----	-----	48,222.17
18	17	H. Francisco.....	5,287.88	17.17	3,363.33	-----	8,668.38
19	25	Nevada Northern Railway Co.....	93,364.54	5,989.71	-----	-----	99,354.25
20	1	P. A. Quigley.....	26,355.98	3,694.06	22.20	-----	30,050.04
21	7	Armstrong & Baker.....	75,407.84	7,082.55	-----	-----	82,490.39
22	23	Nevada Contracting Co.....	-----	-----	-----	-----	-----
23	23	Machine-shop building.....	-----	-----	-----	-----	-----
24	27	Virgin River bridge steel.....	14,210.93	311.06	-----	-----	14,521.99
25	25	Cement contract.....	-----	-----	-----	-----	-----
26	19	J. H. Causten.....	57,159.58	6,638.05	-----	-----	63,817.63
27	30	Pitt-Taylor Syndicate.....	18,415.91	2,701.13	-----	-----	21,117.04
28	29	Pacific States Construction Co.....	46,102.30	5,000.28	55,594.03	-----	106,696.61
29	29-A	Pitt-Taylor Syndicate.....	51,177.29	6,306.57	29,328.91	-----	86,812.77
30	27	Midland Bridge Co.....	1,185.92	1,815.83	-----	-----	3,001.75
31	9	Bishop & Griscom.....	8,300.58	1,365.70	2,387.28	-----	12,053.56
32	32	J. Woods.....	4,407.33	943.47	-----	-----	5,350.80
33	22	Missouri Valley Bridge and Iron Co.....	7,416.19	175.57	-----	-----	7,591.76
34	12	John Ross.....	14,541.37	2,057.18	-----	-----	16,598.55
35	22	Jenkins & Wells.....	3,274.20	642.48	-----	-----	3,916.68
36	28	Bishop & Griscom.....	32,681.16	2,375.79	28,805.68	-----	63,862.63
37	29-B	W. J. Schmidt.....	7,303.18	1,033.45	2,375.45	-----	10,712.08
38	29-B	W. J. Schmidt.....	-----	269.51	503.28	-----	772.79
39	14	John Ross.....	-----	-----	-----	-----	-----
40	35	Shepard & Weber.....	-----	-----	-----	-----	-----
		Section 8 Projects					
	1-8	Toponah Project.....	22,516.83	-----	-----	-----	22,516.83
	2-8	Austin-Eureka Project.....	31,000.00	-----	-----	-----	31,000.00
	3-8	Current Creek Project.....	1,700.00	-----	-----	-----	1,700.00
		Totals.....	\$1,114,240.69	\$136,457.32	\$286,867.93	\$41,558.35	\$1,579,124.29

SEGREGATION OF MAINTENANCE EXPENDITURES

County	Route No.	1919	1920	Grand total	Route No. 1	Route No. 2	Route No. 3	Route No. 4	Route No. 5
Churchill	1	\$1,203.68	\$1,863.67	\$3,067.35	\$3,067.35	\$3,174.49			
Churchill	2	990.71	2,183.78	3,174.49					\$9,730.28
Clark	5	1,478.39	8,251.89	9,730.28					192.15
Clark	5	4.47	187.68	192.15					
Douglas	3		2,584.87	2,584.87			\$2,684.87		
Elko	1	1,690.17		1,690.17	1,690.17				
Elko	3	3,550.20	935.93	4,486.13			4,486.13		
Esmeralda	3	639.59		639.59	639.59				
Eureka	1	351.49		351.49		351.49			
Eureka	2	1,064.30		1,064.30	1,064.30				
Humboldt	1	132.91		132.91		132.91			
Lander	2	2,440.45	919.74	3,360.19	3,360.19				
Lyon	1	90.18		90.18		90.18			
Lyon	3		2,034.63	2,034.63			2,034.63		
Nye	4	579.59	5,097.69	5,677.28				\$5,677.28	
Nye	5	3,253.65	13,402.52	16,656.17					16,656.17
Ormsby	5	1,076.58	1,533.75	2,610.33			2,610.33		
Pershing	3	3,382.94	1,592.25	3,975.19					
Pershing	1	3,448.77	2,351.93	5,800.70	3,975.19				
Washoe	1	3,436.97	1,930.83	5,367.80	5,800.70				
Washoe	3	515.17		515.17			5,367.80		
White Pine	2		250.00	250.00		765.17			
Totals		\$29,330.21	\$44,121.16	\$73,451.37	\$19,597.49	\$4,514.24	\$17,083.76	\$5,677.28	\$26,578.60

PLANT AND YARD OPERATIONS

Operation items	Machine shop	General yard	Operation stockroom	Stock account debits					Equipment stock
				Tires	Gas and distillate	Oil and greases	Supplies	Parts	
1. <i>Pro Rata of Overhead.</i> -----	\$1,130.69	\$259.88							
2. <i>Machine-Shop Operation</i> -----									
A. Expendable tools.-----	138.07								
B. Supplies.-----	333.27								
C. General repairs.-----	736.56								
D. Nonexpendable tools.-----	288.78								
E. Repair fund charges.-----	6,788.77								
F. Additional equipment.-----	9,765.46								
G. Tire fund charges.-----	516.73								\$4,827.02
3. <i>Yard Operations</i> -----									
A. Material storage.-----		237.07							
B. Direct labor and supplies.-----		4,012.28							
4. <i>Stock Operations</i> -----									
Tire stock purchased.-----				\$3,542.78	\$963.08				
Gasoline and distillate.-----							\$2,840.77		
Supplies.-----						\$968.21		\$1,885.47	
Oils and greases.-----								294.01	
Parts.-----								111.80	
War material parts.-----									
Operating prorated.-----			\$604.49	209.95	57.07	57.37	168.30		
Operating totals.-----	\$138,487.64	\$4,249.35		\$3,752.73	\$1,020.15	\$1,025.58	\$3,009.07	\$2,291.28	\$4,827.02

CONSTRUCTION AND PROFIT AND LOSS ACCOUNTS, RENO PLANT

Construction units				Profit and loss accounts				
Cost units		Machine shop	Office and stock building	Yard and equipment storage sheds	Operating expenditures		Sales and revenues	
					Items	Amounts	Items	Amounts
A. Prorata of overhead			\$396.57	\$721.55	Machine-shop operations	\$18,487.64	Tire sales	\$3,202.23
1. Shop building construction		\$1,099.78			Yard operations	4,249.35	Gas and distillate sales	1,800.46
2. Machinery and placing		8,764.73			Tires	3,752.73	Oil and grease sales	419.18
3. Office stock building		8,781.26			Gas and distillate	1,020.15	Supplies sales	7,322.45
4. Gas and oil storage plants			3,875.67		Oils and greases	1,025.58	Parts sales	2,940.11
5. Machine shop floor			2,243.67		Supplies	3,009.07	Truck rentals	30,440.03
6. Machine shed No. 1		425.64		3,009.01	Parts	2,291.28		
7. Storage shed No. 2				4,776.79	Equipment stock	4,827.02		
8. General yard construction				4,012.28	Plant depreciation	1,282.55		
9. Office equipment			369.69		Gross expenses	\$39,945.37	Gross revenue	\$46,124.46
Total cost building and storage units				\$12,519.63	Inventory value of stock	5,716.60		
Office and stock building			\$6,885.60		Net operating expenses	\$34,228.77		
Machine shop unit		\$19,071.41			To balance	11,895.69		
Total plant costs				\$38,476.64		\$46,124.46	Net profit	\$46,124.46
Depreciation 6 months, at 15 year life				1,282.55				\$11,895.69
Asset value of plant Nov. 30, 1920				\$37,194.09				

LAHONTAN PLANT OPERATION

Items of cost	Distribution		Grand total construction costs
	Plant construction	Spur-track construction	
Plans and designs.....	\$684.71	-----	\$684.71
Supervision.....	803.96	-----	803.96
Materials.....	20,619.97	-----	20,619.97
Supplies.....	3,704.00	-----	3,704.00
Labor costs—Direct.....	14,894.29	\$2,759.34	17,653.63
Indirect labor—Boarding-house.....	1,453.88	-----	1,453.88
Equipment—Machinery.....	22,714.99	-----	22,714.99
Grand total construction costs.....	-----	-----	\$67,635.16
Depreciation, five months' operation.....	-----	-----	14,665.50
Inventory value of plant.....	-----	-----	\$52,969.66

PLANT OUTPUT

Cont. No.	Location	County	Tonnage of output			Value charged to construction jobs
			Tons of gravel	Tons of sand	Total output	
12	Reno to Huffakers.....	Washoe...	4,982.60	3,830.86	8,813.46	\$17,831.32
28	Huffakers to Washoe Summit.....	Washoe...	5,319.45	4,236.25	9,555.70	19,341.31
29	Washoe Summit to Franktown.....	Washoe...	1,470.95	2,005.70	3,476.65	7,035.52
31	Bridge, Evans Creek.....	Washoe...	287.50	140.00	427.90	865.92
36	Minden-Gardnerville.....	Douglas...	2,010.55	2,791.00	4,801.55	9,716.61
37	Franktown-Lakeview.....	Washoe...	80.55	101.95	182.50	369.31
38	Franktown-Lakeview.....	Washoe...	93.05	155.65	248.70	503.28
	Maintenance Washoe 3-B.....	Washoe...	70.95	-----	70.95	143.58
	Board of Prison Commissioners.....	Ormsby...	104.00	-----	104.00	211.27
	Stock piled at plant.....	-----	-----	10,000	10,000.00	-----
	Total plant output.....	-----	-----	-----	37,681.81	-----
	Charged to construction jobs.....	-----	-----	-----	-----	\$56,018.24

LAHONTAN PLANT CONSTRUCTION

Operating items	Operation	Maintenance and boarding-house	Totals
Materials.....	\$1,784.57	-----	\$1,784.57
Supplies.....	1,240.75	-----	1,240.75
Fuel and oils.....	5,808.30	-----	5,808.30
Labor costs—Direct.....	19,755.12	-----	19,755.12
Miscellaneous.....	3,489.62	-----	3,489.62
Supplies.....	-----	\$2,861.97	2,861.91
General repairs.....	-----	1,090.91	1,090.92
Labor costs—Direct.....	-----	2,080.42	2,080.40
Truck operations.....	-----	659.90	659.98
Boarding-house—Indirect.....	-----	2,370.18	2,370.10
Spur-track maintenance.....	-----	211.00	211.07
Totals.....	\$32,078.36	\$9,274.38	\$41,352.74
Total plant output.....	-----	-----	\$37,681.81
Loading cost per ton.....	-----	-----	\$1.097

TABLE SHOWING INCOME AND EXPENDITURES—COUNTY-STATE HIGHWAY FUNDS

County	Estimated income			Total income to Nov 30, 1920	Disbursements to Nov. 30, 1920		Estimated additional income	
	1917	1918	1919		Paid out of fund to Nov. 30, 1920	Estimated balance in fund	Taxes, 1920	Total to June 30, 1921
Churchill.....	\$5,850.81	\$9,070.58	\$9,174.18	\$24,095.57	\$16,070.56	\$8,025.01	\$9,825.50	\$17,850.51
Bond sales.....	-----	-----	75,000.00	-----	-----	-----	-----	-----
Clark.....	-----	8,824.43	8,175.65	91,500.08	4,613.83	86,886.25	8,765.51	95,651.76
Bond sales.....	-----	-----	14,740.44	-----	-----	-----	-----	-----
Douglas.....	2,129.59	3,467.88	3,581.21	23,919.12	23,919.12	-----	4,072.76	4,072.76
Elko.....	25,102.56	40,791.48	41,112.61	107,006.65	21,183.59	85,823.06	44,762.22	130,585.28
Esmeralda.....	3,972.35	5,551.58	5,909.06	15,432.99	11,845.57	3,587.42	5,614.40	9,201.82
Eureka.....	4,222.86	6,628.07	6,394.84	17,245.77	-----	17,245.77	7,065.68	24,311.45
To Pershing.....	-----	-----	26,500.25	-----	-----	-----	-----	-----
Humboldt.....	18,530.51	29,744.69	17,687.37	39,462.32	-----	39,462.32	19,108.57	58,570.89
Lander.....	3,901.92	6,299.85	6,396.32	16,598.09	8,083.43	8,504.66	6,843.43	15,348.09
Special Fund.....	-----	-----	20,000.00	-----	-----	-----	-----	-----
Lyon.....	5,488.59	9,784.72	10,331.31	45,604.62	41,474.04	4,130.58	11,323.73	15,454.31
Bond sales.....	-----	-----	30,000.00	-----	-----	-----	-----	-----
Mineral.....	3,218.45	4,901.77	4,632.24	42,752.46	7,450.72	35,301.74	4,981.48	40,283.22
Nye.....	7,527.24	11,231.47	11,117.04	29,875.75	12,828.14	17,047.61	11,930.45	28,978.06
Ormsby.....	1,151.71	1,750.76	1,783.87	4,686.34	4,686.34	-----	1,808.61	1,808.61
From Humboldt.....	-----	-----	26,500.25	-----	-----	-----	-----	-----
Pershing.....	-----	-----	12,498.31	38,998.56	38,998.56	-----	13,928.81	13,928.81
Bond sales.....	-----	-----	32,064.91	-----	-----	-----	-----	-----
Washoe.....	19,689.05	32,506.57	32,429.61	116,690.14	116,690.14	-----	35,835.07	35,835.07
White Pine.....	16,016.43	18,942.79	17,524.76	52,483.98	19,278.82	33,205.16	17,434.60	50,639.76
Totals.....	\$116,802.07	\$188,996.64	\$387,053.98	\$666,352.44	\$327,132.86	\$339,219.58	\$203,300.82	\$542,520.40

CHURCHILL COUNTY

In Churchill County the State Highway Department was faced with the knottiest road problem in the entire State, that of building a highway across such country as the Fallon Sink, Frenchman's Flat, and through sandy country such as that located between Fallon and Hazen. The Fallon Sink has always been known as the worst piece of road on the transcontinental highway between New York and San Francisco. Early in the existence of the department it was determined that, as soon as finances would permit, the Fallon Sink would be eliminated. The matter of finances in Churchill County was a very serious one right from the beginning, as the assessed valuation of the county was only slightly in excess of \$8,000,000 in 1917, meaning a maximum income to the county and state highway funds of \$16,000 per year.

Churchill County is crossed by two routes of the State Highway System—Route No. 1 along the Southern Pacific Railroad from near the old Salt Works to the north Churchill county-line near Miriam, and the other that portion of Route No. 2 from just west of Hazen to the east county-line beyond Eastgate, both routes including a mileage of approximately 140 miles. Route No. 2 is a section of the Lincoln Highway, being a part of the transcontinental highway between New York and San Francisco. This section of Route No. 2 in Churchill County probably presents more varied road-building problems than any stretch of equal length on the entire State Highway System. We cannot better express the highway situation in Churchill County than by quoting a short editorial comment from a recent issue of the Churchill County Standard, which states:

State highway authorities maintain that this county presents most vexatious road-building problems. A project that is entirely feasible of consummation elsewhere within Nevada assumes a most complex nature here because of climatic and soil conditions. Road-building materials are absent here, lack of congealing moisture spells the maximum of road wear and tear, and small tax values add to the general discomfiture of those entrusted with the job of providing suitable roads in this county that will handle the growing volume of traffic.

The soil of the territory in the immediate vicinity of Fallon is of a rich sandy loam with areas of drift sand of frequent occurrence, presenting a construction problem for any type other than concrete or similar permanent pavement. The cost of concrete being prohibitive, we had to resort to gravel or some type cheaper than cement. The use of gravel, however, is costly and after placing not entirely satisfactory because of the lack of moisture for binding and, in the case of work already done in Churchill County, the long and expensive haul for the gravel. The Fallon Sink is the sink or lake of final disappearance of the Carson River and is really an immense saline bed which has been carried down by the river and deposited between two mountain ranges. It is also the last vestige of old Lake Lahontan which geologists tell us in prehistoric times, together with Lake Bonneville, occupied the entire intermountain plateau now composing the State of Nevada and parts of Oregon and Utah. The soil of the Fallon Sink is peculiar unto itself, being of a light spongy nature. This soil has more or less successfully defied all attempts at road building during the past,

the freighters of the early days making it a practice when crossing the sink with empty wagons to load them up with boulders and dump them along their trail across the sink. As time went on this built up a sort of embankment with a beaten track which was passable until wet weather came along, and then woe unto him who in crossing was compelled to get out of the worn rut.

The city of Fallon is a thriving and rapidly growing community and is the hub of the Newlands Reclamation Project, and we felt that, because of the rapid development of this territory, Churchill County should have first consideration for road improvement. Accordingly the first year's program of the department, laid out in 1917, and consisting of eight projects, included an important one in Churchill County, being the section of road from Fallon to Leeteville, an eight-mile section of the Fallon-Hazen road, including two bridges, one of 85-foot span and the other of 120 feet. This project was followed by the Fallon Sink project at a later date, and since the submitting of these first two projects two others have been added to the program for Churchill County.

An important aid to us in the Churchill County work has been the financial assistance of the Lincoln Highway Association on the Fallon Sink project. This association early in 1918 received a donation of \$120,000 from prominent members of the automobile industry in the East to be offered to the State of Nevada for aid in improving the Lincoln Highway on certain specified sections across the State. A complete history of this aid is given in the chapter of this report dealing with this project.

The following is a brief review of the activities of the department in Churchill County together with a report of the status of the work on each project to date:

Fallon to Leeteville

This project, as originally laid out, contemplated the construction of a sand-clay type of road between the city limits of Fallon and Leeteville, including two bridges—one over the Carson River and the other over the Government Canal. The project statement was submitted to the Federal Government on October 24, 1917. The matter of location and the question of rights of way on this project were quite important ones, and after a very thorough reconnaissance this department was convinced that the proper location for the road should be parallel with and on the south side of the railroad, thus entirely eliminating two railroad crossings on this eight-mile section. This meant an entirely new location for a distance of approximately two miles, involving the acquisition of new rights of way. This department accordingly proceeded with the survey along the line of reconnaissance, and on completion of the survey took up with the Board of County Commissioners the matter of rights of way and costs. The County Commissioners agreed that the location as adopted was the proper one for the road, and also agreed to undertake the securing of the needed rights of way free of cost to the State within a reasonable time; and, without resorting to condemnation proceedings, all necessary rights of way were finally secured.

The project, as originally submitted in 1917 calling for a sand-clay surface 15 feet wide on a 21-foot roadbed with a 137-foot concrete-pile trestle over the Carson River and a 65-foot steel-skew truss over the

Truckee-Carson Canal, the total length of the project being 8 miles, was estimated to cost the sum of \$57,195.20.

Owing to the fact that the Government would share only 50% of the cost and to the further fact that the State will only provide an amount equal to 25% of the cost, it was necessary that additional funds be provided by the county. Accordingly, at a meeting with the Board of County Commissioners the county agreed to make provision for the raising of the additional sum of money, the apportionment of estimated costs then being as follows:

Federal Government—50%.....	\$28,597.60
State share—25%.....	14,298.80
Churchill County—County-State Highway Fund.....	5,838.39
Churchill County Special Fund.....	8,460.41

Total estimated cost, 1917.....	\$57,195.20
---------------------------------	-------------

After submitting the project statement to the Federal Government we carried on very extensive investigation of available deposits of clay and other types of surfacing material. After exhaustive tests of available clays, and after observing climatic conditions through the season of 1918, we decided that a sand-clay road would not be satisfactory on this section, both due to poor qualities of available clay and long dry summer seasons. Accordingly a new estimate was prepared and forwarded to the federal authorities, the type of surfacing being changed from sand-clay to a gravel surface 5 inches deep after compacting, 15 feet wide on a 21-foot roadbed, also making both bridges of the reinforced concrete type. The nearest available gravel of suitable quality was located at the Lahontan Dam, necessitating a railroad haul and loading of the gravel at the pits. On advertising for bids in 1918 we were unable to get even reasonable bids on the basis of the contractor loading and furnishing the gravel, so that finally the State decided to furnish the gravel to the contractor f. o. b. at the nearest railroad siding. Accordingly bids were asked for early in 1919 for doing the work on the roadway sections, the State to furnish the gravel for surfacing. The contract for this work was entered into with Baker & Armstrong in September, 1919.

The contracts for the two bridges were awarded to Messrs. Parrott & Thompson of Salt Lake City, Utah, in January, 1919.

Under the roadway contracts it was necessary for the State to construct a gravel-loading plant at Lahontan, also to negotiate with the United States Reclamation Service for the gravel from the Lahontan pits. The Reclamation Service was good enough to allow the use of the gravel without cost and also to assist us in every way possible in the loading operations at Lahontan. After letting the bridge and roadway contracts, the revised estimate of cost was submitted to the Federal Government, showing a total estimated cost of \$108,298.41, prorated as follows:

Federal Government.....	\$47,926.96
State share.....	30,185.73
Churchill County.....	30,185.72

A comparison of the above estimate with that of 1917 illustrates very graphically the increase in 1920 construction costs over those which prevailed in 1917.

The two bridge contracts were completed early in 1920, and the roadway contract was completed and the road opened to traffic in September of the present year.

Salt Wells to Sand Springs

This project covers the famous Fallon Sink, and presented the real road problem in Churchill County. Early in the existence of the department finances would not permit the improvement of this section; however, early in 1919 the Lincoln Highway Association came forward with an offer of financial assistance on certain sections of the Lincoln Highway across Nevada, chief among which was the Fallon Sink section from Grimes Ranch to Sand Springs, that association agreeing to pay on this particular project the sum of \$45,000, the balance of the cost to be met by the State and Federal Government. This gift of the association made it possible for the department to finance the Fallon Sink job, and we at once proceeded with the preparation of project statements and the making of surveys and plans for this project. The project statement covering the entire section between Grimes Ranch and Sand Springs, a distance of 17.3 miles, was submitted to the Federal Government on September 26, 1919. The improvement contemplated by the statement would consist of a gravel roadway of 20 feet, top width, a surface of gravel or crushed rock 12 feet wide, with 18-foot turnouts every 2,000 feet, the minimum height of fill to be 3 feet above the sink level, and with drainage structures of permanent concrete. When submitting this project statement it was very difficult to estimate the cost of doing the work, and therefore the estimates submitted were made sufficiently high to meet all contingencies. This estimate as included was therefore \$220,440, to be borne by the Federal Government, the Lincoln Highway Association, and the State. During the season of 1919 we advertised for bids for the grading and structures on the section between Salt Wells and Sand Springs, a distance of 10 miles, and were successful in awarding the contract for this work on October 22, 1919, to W. J. Schmidt of Berkeley, Calif. Work began under this contract in April, 1920, and the contract was completed during September of the same year. Under this contract a fill approximately $3\frac{1}{2}$ feet higher than the level of the surrounding flats was thrown up for the entire ten miles, with a minimum width of 20 feet, 18-foot turnouts every 2,000 feet, and with the highest type of reinforced concrete box culverts. This grade is now ready for surfacing, which will be done under separate contract during the year 1921. The total estimated cost of the contract complete, together with its apportionment to the various participants, is as follows:

Federal Government.....	\$37,372.50
Lincoln Highway Association.....	26,876.25
State share.....	10,496.25
Total cost.....	\$74,745.00

The balance of the gift of the Lincoln Highway Association will be used in completing the project between Grimes Ranch and Sand Springs, consisting of the surfacing of the grade thrown up under the Schmidt contract, and the grading and structures, with graveling, of the balance of the project between Salt Wells and Grimes Ranch.

Leeteville to Hazen

A project statement covering the section of Route No. 2 between Leeteville and Hazen was submitted to the Federal Government on May 6, 1920, providing for a gravel road 8.27 miles in length, 15 feet

wide on a 21-foot roadbed, together with a 50-foot reinforced concrete bridge over the "L" line canal of the United States Reclamation Service. The estimated cost of this section, together with the apportionment to the various participants, is as follows:

Federal Government.....	\$60,574.40
State share.....	30,287.20
Churchill County.....	30,287.21
Total cost.....	\$121,148.81

This project, together with Federal Aid Project No. 3, Fallon to Leeteville, will give an improved highway for the entire distance of 17 miles between Fallon and Hazen. It is our expectation to get this latter project under way during the season of 1921 providing the county is able to finance its share of the cost.

Fallon to a Point Six Miles South

The Highway Department, in cooperation with the Board of County Commissioners, has had under consideration the pavement of approximately six miles of highway in a southeasterly direction out of Fallon on State Highway Route No. 2. Inasmuch as the matter of finances has not been finally disposed of, it may be said that this project is only in the preliminary stage and may or may not be taken up during the season of 1921. No surveys other than reconnaissance have been made of this project.

Frenchman's Flat

The Lincoln Highway Association has made available to this department for aid in improving Frenchman's Flat the sum of \$10,000, the project to include the section from the west side of the valley to the Fairview road fork. It is a condition of this gift that the project be placed under way and completed during 1921, and it is the intention of the department that it be so completed. The improvement will consist of a graveled road 10 feet wide, 5 inches thick on a 20-foot graded roadway, with 18-foot turnouts every 2,000 feet. The surveys for this project have been completed, the plans are practically complete, and it is our expectation to get the work under way early in the coming year. Project statement covering this project has not yet been submitted to the Federal Government.

Eastgate to Westgate

This is the third project in Churchill County designated for financial aid by the Lincoln Highway Association, the gift of the association on this project being \$7,500. Conditions are that the roadbed width shall be 18 feet, gravel surfaced 9 feet wide and 5 inches in depth, and the approximate length of the project is 15 miles. This project is on the program for the year 1921, and it will doubtless be completed during that year. The project statement covering the project has not been submitted to the Federal Government, neither has the location survey been made.

Survey and Reconnaissance of State Highway Locations

The location of practically the entire system in Churchill County is now determined with the exception of the first section immediately southeast of Fallon and between Eastgate and the east county-line. On this latter section the routing has not been finally determined. On the section between Eastgate and Austin in Lander County the



Reinforced Concrete Girder Bridge over Truckee-Carson Canal near Fallon—85-foot span. Built under Contract 2, Project 3.



Prepared subgrade ready for receiving gravel surface on Fallon-Leeteville Highway. Built under Contract 16, Project 3.

Lincoln Highway Association are offering an additional \$42,000 to assist in construction. This money will be made available to this department in the same manner as previous gifts as soon as it is definitely decided as to the routing of the highway between the two before-mentioned points. The decision as to the routing has been left to this department, and it is expected that final action on same will be taken in the near future, and portions of the section included in the 1921 program of construction.

Finances

The problem of finances in Churchill County may almost be compared to the construction problems because of the fact that the property valuation is comparatively low, providing only limited income from taxation. The gift of the Lincoln Highway Association, \$63,000 of which is designated for expenditure in Churchill County, has been of wonderful aid in putting over and planning a campaign of real construction in the county, and the citizens of the county should duly appreciate this fact. The problem of providing sufficient funds in the county, to take full advantage of the gift of the association and that the county may receive its full measure of federal aid, is quite serious, and merits immediate and earnest consideration by every citizen of Churchill County.

The following summary gives briefly the income and expenditure of the State Highway Department in Churchill County from the date of organization of the department to the present time:

<i>Tax year</i>	<i>Valuation</i>	REVENUE		<i>County-State Highway Fund</i>
		<i>Levy</i>	<i>State Highway Fund</i>	
1917.....	\$8,358,302.72	7 cents	\$5,850.81	\$5,850.81
1918.....	9,070,576.52	10 cents	9,070.57	9,070.57
1919.....	9,174,185.47	10 cents	9,174.18	9,174.18
			\$24,095.56	\$24,095.56
Special tax levy.....				8,460.41
				\$32,555.97
Authorized county bond issue.....				\$100,000.00

EXPENDITURES			
<i>Calendar year</i>	<i>Surveys and plans</i>	<i>Maintenance</i>	<i>Construction</i>
1918.....	\$1,652.09	\$3,541.59	
1919.....	1,642.75	2,194.40	\$46,261.81
1920.....	6,245.82	4,047.45	116,389.27
Total expenditures in Churchill County.....			\$181,975.18

Although the Legislature of 1919 authorized a county bond issue of \$100,000 to aid in the construction of the State Highway System, none of these bonds have as yet been issued. In order to carry through the 1921 program in the county, however, it will probably be necessary to issue some of these bonds.

Surplus War Equipment Delivered to Churchill County

Under the Act of Congress apportioning surplus war material to the state highway departments of the various States, there has been given to Churchill County and the city of Fallon for road and street improvement the following equipment:

No.	Equipment	Dept. No.	Market value	Cost to County	Cost to Fallon
1.....	Nash Quad 2½-ton truck.....	118	\$4,200	\$266.39	
1.....	Nash Quad 2½-ton truck.....	155	4,200	266.39	
1.....	Packard 2½-ton truck.....	211	2,000	.....	\$325
3.....	Totals.....		\$10,400	\$532.78	\$325

In addition to the gift of the above equipment to the citizens of Churchill County at a cost of less than 10% of its market value, the department has also purchased for the county at less than market price supplemental equipment, such as hoists and dump bodies for the above trucks. Through purchase in carload lots and allotment to counties at actual cost, a very material saving was thus effected in this equipment. Churchill County is also entitled to receive its just proportion of the additional equipment which this department will doubtless receive from the War Department from time to time.

CLARK COUNTY

Clark County was left out of the State Highway System as originally designated by the State Highway Act of 1917; however, at the 1919 session of the State Legislature the Act was amended to extend the highway system into Clark County, the amendment designating the extension as Route No. 5, from Goldfield through Beatty, Indian Springs, Las Vegas, and on to the county-line; and Route No. 6 extending across the southern end of the State entirely within Clark County and following what is locally known as the Arrowhead Trail. This amendment was passed in order that the State might immediately take advantage of the L. V. & T. grade then being abandoned by the railroad company, and that the State could negotiate for the purchase of the bridges and structures before any of them were dismantled and torn up. Accordingly, immediately on the passage of the amended Act this department opened negotiations with the railway company for the purchase of the structures and improvements on the entire 110 miles of grade, and within a short time completed a deal for their purchase, the State paying to the railroad company \$3,889.44, which was paid jointly in equal proportions by the State and Clark and Nye Counties. This grade did not actually come into our possession until March, 1919, and the department at once proceeded with the tearing up of the ties and the scarifying and widening of the grade. Owing to the extremely hot weather in the summer months, the work was discontinued after about two months operations to be taken up again in the fall of 1919. After the work was again taken up it was carried to completion. The work consisted of throwing aside the ties, scarifying the grade to a depth of a few inches below the bottom of the tie marks, blading the grade for an equal depth, and throwing the material to the side, giving a grade surface width of 16 to 18 feet, also of the flooring with ties of all the bridges to a total width of 14 feet with guard-rail on each side. The work done to date on the grade gives probably the best 110 consecutive miles of good road in the State, even in its present condition; however, it is the purpose shortly to begin the surfacing with gravel of the sandy and bad stretches of the grade. Because of its being a railroad grade, the location follows beautiful curves, and the maximum gradient is $1\frac{1}{2}\%$, thus giving an extremely fast road for the entire distance.

In October, 1919, the department opened a division office in Las Vegas, placing a division engineer in charge with the purpose of making surveys for future construction on Routes 5 and 6 and in order to avoid the delayed mail service between Carson City and Las Vegas. The surveys were commenced at once, together with the completing of the work on the L. V. & T. grade, both in charge of the division engineer.

Briefly summarized, the following gives the status of the work in Clark County at this time:

Virgin River Bridge at Bunkerville

The first new construction begun in Clark County by this department was the construction of a steel bridge over the Virgin River between Bunkerville and Mesquite on Route No. 6. The crossing of the Virgin River at this point has long been the bugbear of the County Commissioners of Clark County and of the road boosters of the entire southern country. The river at this point is approximately a thousand feet wide consisting of a quicksand bed for the entire width, with the small stream of the river meandering around the bed, first in one place and then in another, presenting an ever-present and unlocated danger in the form of quicksand for the travelers compelled to ford the stream. We are advised that for past years the county has maintained a man and team at this crossing to tow automobiles across, involving a considerable monthly expense for this service.

On November 1, 1919, this department submitted a project statement to the Federal Government covering the construction of a bridge over the river at this point, the structure to consist of two 126-foot steel spans with 495 feet of timber trestle, together with the necessary weir control for the stream, the apportioned cost of the same to the participants being as follows:

Federal Government.....	\$37,427.50
State share.....	18,713.75
Clark County.....	18,713.75
Total estimated cost.....	\$74,855.00

On March 22, 1920, a contract was awarded to the Missouri Valley Bridge and Iron Company of Leavenworth, Kans., for the furnishing of the steel for this structure, and on May 17, 1920, the contract for the construction was awarded to the Midland Bridge Company of Salt Lake City, Utah. Actual construction began on the arrival of the steel in August, 1920, and has progressed satisfactorily since that time. It is expected that the bridge will be completed by April, 1921.

Muddy River Bridge

On July 12, 1920, a project statement was submitted to the Federal Government covering the construction of a new bridge over the Muddy River just east of the town of St. Thomas on Route No. 6, the bridge to consist of a timber-truss type approximately 116 feet in length, and estimated to cost \$7,491, prorated as follows:

Federal Government.....	\$3,745.50
Clark County.....	1,872.75
State share.....	1,872.75

This structure will replace a small wooden structure built by the county which is becoming unsafe because of the caving due to erosion of the stream banks. Advertisements calling for bids for the construction of this bridge are now being run, and the contract will doubtless be awarded by the close of the present year.

Las Vegas-St. Thomas Road

On October 18, 1920, the department submitted a project statement to the Federal Government covering the improvement of that portion of the St. Thomas-Las Vegas road from a point 16.79 miles southwest of St. Thomas to a point 30.10 miles southwest of St. Thomas, a total length of 13.31 miles, the improvement to consist of a graveled road 18 feet wide with permanent drainage structures of corrugated-metal pipe and reinforced concrete. The estimated cost of this project, together with the apportionment of costs, is as follows:

Federal Government.....	\$40,294.87
Clark County.....	25,294.87
State share.....	15,000.00
Total estimated cost.....	\$80,589.74

The surveys for this project are practically complete and the plans are now under way. Bids were called for on this project in November, 1920, but only one bid was received, which was too high, and was rejected. Bids will again be called for in the near future, and it is hoped to have this project under construction in January, 1921. It is also probable that, early in 1921, construction will be begun on an additional ten miles of the Las Vegas-St. Thomas road, the surveys for which are completed.

L. V. & T. Grade Work

As previously stated, on the L. V. & T. grade the ties have been removed, the entire grade has been scarified and widened, and the bridges have been floored. While even now the grade is in excellent condition for probably 85% of its length, there are a few stretches where either sand or soil conditions are bad, notably the flat just south of Indian Springs. Plans are now under way looking toward the surfacing with gravel of all portions of this grade which are now in bad condition both in Clark and Nye Counties. This, when completed, will give an excellent highway from Beatty to Las Vegas, making an important link of the north and south highway. This improved road will also doubtless be an incentive to some enterprising person or firm to begin the operation of a stage-line carrying the United States mail over this route, meaning much faster mail service between Las Vegas and Reno as compared to the present roundabout rail haul by way of Salt Lake City or Los Angeles. The improvement yet to be carried out on this grade will be done by force account by this department, as this will obviate the necessity of making surveys for preparation of plans in order to receive federal aid, the Government having agreed to accept the railroad company's plats in lieu of such surveys. This would not be possible were the work to be contracted, because of the peculiar federal aid regulations which permit the Government to pay 50% of actual cost in force-account work as the work progresses, but only 50% of the estimate in contract work, which may be less than the actual contract price.

Surveys and Reconnaissance of State Highways

Other than the surveys and reconnaissance completed between Las Vegas and Bunkerville on Route No. 6, a considerable amount of reconnaissance work has been done as to the routing of Routes 5 and 6 south from Las Vegas to connections with the state highway systems of Arizona and California. These connections have not as yet been definitely determined, although the reconnaissance surveys made have given the department much valuable information as to the possibility of the various routings.

Finances

Due to the fact that Clark County did not come under the State Highway System until early in 1919, the income from the county to the department has not been as large as that in other counties of equal tax valuation.

The following table shows briefly the department's income and expenditures in Clark County from January 1, 1919, to date:

		REVENUE			
<i>Tax year</i>	<i>Valuation</i>	<i>Levy</i>	<i>State Highway Fund</i>	<i>County-State Highway Fund</i>	
1919.....	\$9,174,185.47	10 cents	\$9,174.18	\$9,174.18	
Authorized county bond issue.....				75,000.00	
					\$84,174.18
EXPENDITURES					
<i>Calendar year</i>	<i>Surveys and plans</i>	<i>Maintenance</i>	<i>Construction</i>	<i>Total</i>	
1919.....	\$5,612.46	\$1,482.86		\$7,095.32	
1920.....	11,900.27	8,439.57	\$17,523.74	37,863.58	
					\$44,958.90

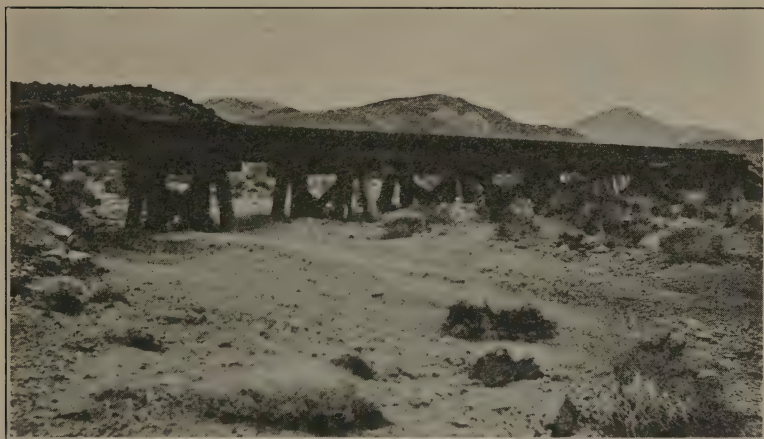
The issue of \$75,000 in bonds, as authorized by the 1919 Legislature for the purpose of aiding in the improvement of the State Highway System in Clark County, has been sold and the amount realized placed to the credit of the County-State Highway Fund.

Surplus War Material Delivered to Clark County

Under the Act of Congress apportioning surplus war material to the various state highway departments, there has been given to Clark County and the city of Las Vegas for road and street improvement the following equipment:

<i>No.</i>	<i>Equipment</i>	<i>Dept. No.</i>	<i>Market value</i>	<i>Cost to County</i>	<i>Cost to Las Vegas</i>
1.....	2½-ton Nash Quad truck.....	90	\$1,800	\$271.85	-----
1.....	2½-ton Nash Quad truck.....	97	1,800	271.85	-----
1.....	2½-ton Nash Quad truck.....	100	1,800	-----	\$364
3.....	Totals.....		\$5,400	\$543.70	\$364

In addition to the above equipment the county will be given its proportion of such other equipment adapted to its needs which will doubtless be received from time to time.



Type of wooden trestles on the L. V. & T. grade. These bridges were all taken over by the department and widened to 14 feet by placing ties end to end and close together. As completed the bridges are excellent structures and saved the State many thousands of dollars.



Widening the L. V. & T. grade in Clark County with 90-hp. caterpillar and heavy scarifiers and drags.

DOUGLAS COUNTY

Douglas County contains practically the entire area of what is known as the Carson Valley and is a large agricultural community. Two separate portions of one state highway route are located in Douglas County—one being the road between Carson City and Yerington leading by way of Minden and Gardnerville; and the other a short section between the Ormsby county-line and the California line on the south shores of Lake Tahoe. No attempt has been made by the department to do construction work on the portion of Route 3 reaching to Lake Tahoe, such work as has been done being confined exclusively to maintenance during the summer months. Very careful thought, however, has been given to the matter of improvement of the balance of Route 3 through Douglas County. This route traverses the almost exact center of the valley, connecting Minden and Gardnerville with the State Capital (Carson City) and continuing on over the Mountain House Summit as a part of the road to Smith and Mason Valleys and to the counties of



The concrete highway through the town of Gardnerville—20 feet wide with 12-foot shoulders. Built under Contract 36, Project 28. Connects the towns of Gardnerville and Minden.

Mono and Alpine in California. This is one of the most important sections of road in the State from the standpoint of producing territory.

Early in the existence of the department a project was outlined for Douglas County, which has been followed by other projects during succeeding years. Briefly outlined, the following is a record of the status of each separate project in Douglas County as of the present date:

Carters to Holbrook

This project covers a section of about four miles, consisting of what is known as the Mountain House Summit. It is intended to improve a section of road which has always given great difficulty in the way of maintenance, and which has at times become impassable during the winter months. A project statement on this section was submitted to

the Federal Government on November 8, 1917, calling for a graveled road 9 feet in width on a 15-foot graded roadbed. The estimate of cost as originally submitted and its apportionment to Government, county, and State was as follows:

Federal Government.....	\$5,615.06
Douglas County.....	2,130.24
State share.....	3,484.82

This project was covered by agreement with the Federal Government, but to date construction work has not begun. We called for bids on this project about two months ago, but no satisfactory bids were received. Surveys and plans are complete.

Minden to a Point $3\frac{1}{2}$ Miles North

Project statement covering this section was submitted to the Government on November 15, 1918, the primary object being to improve the bad section of the present road and to open a new road through the Dangberg field for a distance of $1\frac{3}{4}$ miles, shortening the distance between Carson City and Minden by possibly one mile. The improvement consists of a 15-foot graveled road on a 24-foot roadbed, with permanent structures of reinforced concrete. The contract for this work was let to John O'Keefe on September 9, 1919, and by him sublet to the firm of Kibby & Gibson. Construction work began immediately and is being carried on at the present date. Progress of the contractor had been very unsatisfactory and finally reached the point where in August of the present year a settlement was made with the contractors and the work taken over by the State, the contractors being released from the completion of the graveling of the portion of the contract located through the Dangberg field. Recently the department awarded a contract to Mr. John Ross for the completion of the surfacing work on this section, which is now going forward. The total cost, with apportionment to participants, is as follows:

Federal Government.....	\$22,025.00
Douglas County.....	11,012.50
State share.....	11,012.50
Total cost.....	\$44,050.00

Minden to Gardnerville

This project was submitted to the Federal Government on March 20, 1920, and called for the construction of a concrete pavement between the north city limits of Minden and the south city limits of Gardnerville, a distance of approximately 1.8 miles; pavement to be 6 inches thick and 20 feet wide on a 30-foot roadbed. The contract for this work was let to the firm of Bishop & Griscom on July 26, 1920, and construction work began immediately. The contract was completed and the road thrown open to traffic on December 1, 1920. This section of roadway is one of the finest pieces of pavement that has been built in the State, and the construction was made in record time, despite the fact that great difficulty was experienced in securing sufficient railroad cars to make prompt delivery of materials. This improvement was taken up at the request of the County Commissioners of Douglas County and various citizens of the county. It gives the towns of Minden and Gardnerville an improved main street, and serves to more closely connect the

commercial relations of these two communities. The total cost of this job, as near as it can now be determined, is as follows:

Federal Government.....	\$36,000.00
Douglas County.....	41,996.47
State share.....	8,666.27
Total cost.....	\$86,662.74

Bridges Over the Carson River near Cradlebaugh

A proposed project is now being prepared for the improvement of approximately 2½ miles in the vicinity of Cradlebaugh Bridge. This will mean a new location from the present curve towards Cradlebaugh Bridge straight through to the new road built by Douglas County two years ago, and will give a tangent from the first turn to the north of Minden almost to the Stewart Indian School near Carson City. The project will include the construction of two reinforced concrete bridges over the Carson River, together with grading and graveling of about 2½ miles of road. No estimates are at present available, but it is expected that this project will be taken up early in 1921.

Survey and Reconnaissance of State Highway Locations

Route 3 through Douglas County has been surveyed in its entirety, except a short section on the shores of Lake Tahoe, and plans have been prepared covering the major portion of such surveys. Any further improvements taken up in subsequent years, therefore, will mean that there will be no necessity of further location surveys.

Finances

The finances of Douglas County from a taxation standpoint are very limited, the total valuation of the county being small as compared with some of the other counties. To aid the department in carrying on the construction of the State Highway System, and to aid the County Commissioners in their road-building work, the last session of the Legislature passed a bill authorizing the Board of County Commissioners of Douglas County to issue bonds in the amount of \$150,000. It is from this bond issue that the county is paying a major portion of its share of the cost of the work now under way and completed.

The following is a brief summary of the revenue and expenditures of the department in Douglas County since organization in 1917:

		REVENUE			
<i>Tax year</i>	<i>Valuation</i>	<i>Levy</i>	<i>State Highway Fund</i>	<i>County-State Highway Fund</i>	
1917.....	\$3,042,275.00	7 cents	\$2,129.59	\$2,129.59	
1918.....	3,467,877.00	10 cents	3,467.87	3,467.87	
1919.....	3,581,214.00	10 cents	3,581.21	3,581.21	
			\$9,178.67	\$9,178.67	
Authorized county bond issue.....				\$150,00.00	
EXPENDITURES					
<i>Calendar year</i>	<i>Surveys and plans</i>	<i>Maintenance</i>	<i>Construction</i>	<i>Total</i>	
1917-1918.....	\$1,248.69			\$1,248.69	
1919.....	2,312.31		\$7,559.80	9,872.11	
1920.....	4,056.40	\$2,584.87	82,294.85	88,936.12	
Total expenditures in Douglas County.....				\$90,056.92	

Surplus War Equipment Delivered to Douglas County

Under the Act of Congress apportioning surplus war material to the various States there has been allotted to Douglas County the following:

No.	Equipment	Dept. No.	Market Value	Cost to
				Douglas County
1.....	2½-ton Nash Quad truck.....	148	\$4,200.00	\$266.39
1.....	2½-ton Nash Quad truck.....	130	4,200.00	266.39
1.....	1½-ton Kelly-Springfield truck.....	183	1,800.00	225.00
1.....	2-ton Nash Quad truck.....	84	1,800.00	364.00
<hr/>			<hr/>	<hr/>
4.....	Totals			
			\$12,000.00	\$1,121.78

The Highway Department has also purchased for Douglas County dump bodies and hoists for the above trucks, which were purchased considerably under market prices, and this saving was effected by the county. It is probable also that additional equipment will be given to the county as it becomes available from the Government.

ELKO COUNTY

Elko County is the richest county in the State—in fact, it is an empire in itself, equaling in area some of the populous eastern States. This county is the seat of the ranching and stock-raising industry of the State, and the general topography is such as to make open-range conditions ideal for this industry.

Only one route of the State Highway System crosses Elko County, being Route No. 1 along the main line of the Southern Pacific Railroad, extending from the west county-line near Carlin to the Utah state-line near Montello, with a total mileage of approximately 135 miles. This location follows the valley of the Humboldt River between Carlin and the north limits of Starr Valley, and along the course of this river soil conditions are such as to require considerable careful investigation covering drainage, locations, and the availability of suitable surfacing material. The question of suitable gravel for surfacing in this county is quite a serious one, as the investigations conducted by this department to date indicate very limited quantities of suitable material located within reasonable hauling distance of the state highway. Freight rates on cement and other road-building materials from outside sources into Elko County are so high as to make almost prohibitive the cost of concrete or other type of permanent pavement, so that to date this department has not given serious consideration to types of construction other than gravel, shale, or crushed rock, or such types as will make use of local materials.

The location of the State Highway System through Elko County wherever possible follows and makes use of the old abandoned Southern Pacific grade, the use of which means a very material saving in the cost of excavation. The use of this grade, however, in many cases involved with the Southern Pacific Company the question of rights of way lying within the old railroad right-of-way grant 400 feet in width. Because of the necessity in some cases of paralleling the railroad through narrow canyons, it was imperative that we make use of this abandoned railroad grade, and it meant a long series of negotiations with the railroad company for the right of way, even to the extent of filing condemnation suits, which were afterwards compromised.

At the very beginning of the existence of the State Highway Department it was realized that, because of its location and wealth, Elko

County was entitled to first consideration in state highway construction. Therefore, early in 1917 there was submitted to the federal authorities, a project statement covering the road from Elko to Carlin, it being the intention to get this section under construction the following year. Under war conditions, however, construction was not gotten under way until April, 1919. The above statement was followed in 1918 with one covering the section from Carlin north to the county-line at Maggie Creek, and later by a third project statement covering the section between Elko and Halleck.

The following is a brief review of each project in the county, together with the status of the work at this time:

Elko to Vivian

Surveys were completed and project statement was submitted to the Federal Government in the year 1917. Plans were gotten out early in 1918 and advertisements, asking for bids on construction, were inserted in local papers and coast trade journals. At about the same time the War Industries Board took control of all construction in the United States, and under their orders we were not allowed to proceed with any new construction, and construction under way was limited to actual necessity. This prevented any construction work other than maintenance in Elko County during 1918. Early in 1919 bids on this section were again asked for, and on April 19 the contract was awarded to J. H. Rooney and associates of Santa Monica, Calif., the estimate of cost being as follows:

<i>Cost</i>		<i>Prorated</i>	
Contract price.....	\$106,112.48	Federal Government—50%...	\$57,513.81
Engineering, construction, 10%	8,915.14	Elko County—25%.....	28,756.91
		State—25%.....	28,756.90
	<u>\$115,027.62</u>		

Construction began immediately and progressed fairly well for a few months, the contractor, even during this period, however, not making progress satisfactory to this department. During this first season work to the approximate value of \$49,000 was handled, the contractor, on account of bad weather, being forced to close down operations about November 30. Operations were again resumed in May, 1920, on a very small scale and dragged along in a haphazard manner until late in the summer, at which time the department came to the conclusion that some drastic action would have to be taken to secure better progress. Accordingly, during July the contractors were notified to meet with the directors at Carson City and at that time an agreement was reached for the employment of competent superintendents and, as we thought, provision made for better progress. Even under this arrangement, however, progress was still slow, so that finally, on September 30, the Board of Directors and the Highway Engineer made an inspection of the work and were so dissatisfied with the general aspect that the department took over the operation of the contract and placed the resident engineer in charge of construction. At the closing down of operations on November 20 the condition of the job was as follows:

Excavation, 90% complete, only finishing and shoulder work left.
Gravel surface, 6 miles, 30% complete.

This means that the job should be completed early in the coming season.

Elko to Halleck

This project covers the important road leading from Elko to the North Fork country and on to Halleck and to the entire eastern portion of Elko County. It is one of the most important roads in Elko County, and one greatly in need of improvement over a great portion of its length. The survey covering this section was made during the fall and winter of 1919, and the plans were begun early in the present year. A revised project statement was submitted to the Federal Government in June, 1920, covering the entire twenty miles, a



The Moleen Hill on State Highway under construction in Elko County.

statement having been previously submitted in 1918 covering only the portion from Elko to North Fork road. Under the amended statement the total cost of the project is estimated as follows:

<i>Cost</i>	<i>Prorated</i>
Construction.....\$194,600.00	Federal Government—50%.....\$107,030.00
Engineering and construction. 19,460.00	Elko County—25%..... 53,515.00
	State—25%..... 53,515.00
<u>\$214,060.00</u>	

On this and the following project the matter of roadway width as between the width thought advisable by this department and the width desired by the federal authorities was the one factor that prevented the letting of contracts covering these two projects during the season

of 1920. In this matter of roadway width this department is opposed to the construction of a roadway greater than 21 feet in width on outlying projects which carry traffic comparable with these Elko projects. The Bureau of Public Roads, however, has been almost insistent for a minimum roadway width of 24 feet. This department takes the attitude that a 21-foot roadbed, which provides a 15-foot surface with 3-foot shoulders on each side, is ample for all traffic needs both now and in the future on 95% of the State Highway System. Furthermore, the item of additional cost for the additional 3-foot width is a very serious one, and in many cases would prohibit the construction of contemplated projects because of lack of finances, or, if proceeded with, would so reduce the length of the project as to seriously reduce the benefit to the territory adjacent to the project. The question of this roadway width was first raised by the Bureau of Public Roads in April, 1920, in the case of plans for a project in Pershing County, and a flat refusal was made by the bureau to approve the plans on this and similar projects when a roadway width of 21 feet was provided. This effectively stopped further progress on all similar projects until this question of roadway width was threshed out with federal authorities.

We immediately carried the matter to the Chief of the Bureau, and, after several months, or in September, 1920, succeeded in convincing the bureau that a flat ruling of a minimum roadway width was not applicable to Nevada, and that some of our projects had been approved with a lesser width. A complete review of our negotiations with the federal authorities appears in the section of this report devoted to federal aid.

Although we were partially successful in our fight on the minimum roadway width, it was so late in the season that we decided it would not be advisable to proceed with the letting of contracts on the two remaining projects, as the winter season would set in almost before the work could be commenced. It was, therefore, decided not to attempt to let a contract covering this section until early in 1921. Accordingly, just recently an advertisement was published in local and state papers advising interested bidders that bids would be called for on this job early in January, 1921, and requesting them to view same at this time in preparation for bidding in January. This means that this project should be commenced by March of the coming year. This will be a gravel-surfaced road with permanent concrete drainage structures.

Vivian to West Elko County-Line

This project is an extension of the Elko-Vivian project and will carry the construction from the city of Elko to the western limits of the county. The mileage of this project, as covered by project statement submitted in 1918 is 8.1, estimated to cost as follows:

<i>Cost</i>		<i>Prorated</i>	
Construction.....	\$47,024.50	Federal Government—50%.....	\$25,863.47
Engineering and construction.	4,702.45	Elko County—25%.....	12,931.74
		State—25%.....	12,931.74
	<u>\$51,726.95</u>		

It is expected that this project will be contracted for construction early in the coming season. It was not advertised for bids during the past season because of the same reasons as applied to the Elko-Halleck project. All surveys and plans have been completed on this project.

Surveys and Reconnaissance of State Highway Location

From Wells to the Utah state-line there are several possibilities as to state highway routing. The State Highway Act provides that Route No. 1 shall follow a general course through the towns of Montello, Cobre, Wells, Deeth, etc. Considerable thought has been given to the possibility of locating on some direct line from near Wells to Wendover, this location being urged by many residents of Elko County. In furtherance of this, the department just recently had a thorough reconnaissance made of the two routes from Wells to the Utah line by a competent engineer. The Wendover route has been urged by the state highway authorities of Utah on account of the work done by them on the Wendover cut-off and because it would afford a direct connection with Salt Lake City to the south of Great Salt Lake.

Between the towns of Deeth and Wells there also came up a question of location—whether to follow the old abandoned Southern Pacific grade or the present road location through Starr Valley. During September, however, and after thorough investigation of the merits of the two locations, the Board of Directors definitely adopted the Starr Valley location as the route of the state highway between Deeth and Wells.

Finances

Elko County is the wealthiest county in the State, the revenue to the State and County-State Highway Funds being larger than the revenue of any other county. Expenditures of the department in Elko County have not been as extensive as in many of the counties, because we were prevented from getting additional contracts under way during the construction season of 1920 on account of the refusal of the Bureau of Public Roads to approve a roadway width of 21 feet as herein previously outlined. We feel, however, that this will mean a much larger work during the season of 1921, as it is the sincere belief of this department that contracting conditions will be much more favorable through better labor conditions and lower material costs, thus meaning quite a saving in construction costs over those prevailing during the season of 1920.

The following tabulation sets forth briefly the department income and expenditures in Elko County from the time of organization to date:

		REVENUE		State	County-State
<i>Tax year</i>	<i>Valuation</i>	<i>Levy</i>	<i>Highway Fund</i>		<i>Highway Fund</i>
1917.....	\$35,860,805.00	7 cents	\$27,102.56		\$27,102.56
1918.....	40,791,486.00	10 cents	40,791.48		40,791.48
1919.....	41,112,609.00	10 cents	41,112.60		41,112.60
			\$109,006.64		\$109,006.64
EXPENDITURES					
<i>Calendar year</i>	<i>Surveys and plans</i>	<i>Maintenance</i>	<i>Construction</i>	<i>Total</i>	
1917.....	\$1,919.41			\$1,919.41	
1918.....	2,106.63	\$183.95		2,290.58	
1919.....	1,585.82	1,690.17	\$45,254.98	48,530.97	
1920.....	4,092.47		23,536.38	27,628.85	
Total expenditures in Elko County.....				\$80,369.81	

Surplus War Material Delivered to Elko County

Under the Act of Congress apportioning surplus war materials to the state highway departments there has been given to the county of Elko and the city of Elko for road and street improvements the following-described equipment:

No.	Equipment	Dept. No.	Mkt. value	Cost to County	Cost to City of Elko
1.....	Heavy Aviation 3½-ton truck.....	102	\$3,600	\$308.25	
1.....	Heavy Aviation 3½-ton truck.....	103	3,600	308.25	
1.....	Nash Quad 2-ton truck.....	135	3,600	266.39	
1.....	Nash Quad 2-ton truck.....	149	3,600	266.39	
1.....	Heavy Aviation 3½-ton truck.....	107	3,600	298.20	
1.....	Heavy Aviation 3½-ton truck.....	110	3,600	298.20	
1.....	Peerless 3½-ton truck.....	68	3,000	544.45	
1.....	Heavy Aviation 3½-ton truck.....	108	3,600	328.20	
1.....	Heavy Aviation 3½-ton truck.....	109	3,600	328.20	
1.....	Heavy Aviation 3½-ton truck.....	111	3,600	328.20	
1.....	Heavy Aviation 3½-ton truck.....	112	3,600	328.20	
1.....	Kelly-Springfield 1½-ton truck.....	190	1,800	225.00	
1.....	Kelly-Springfield 1½-ton truck.....	176	1,800	225.00	
1.....	Packard 2½-ton truck.....	203	1,000	325.00	
1.....	Packard 2½-ton truck.....	207	1,000	325.00	
1.....	Heavy Aviation 3½-ton truck.....	199	3,600	.....	\$325.00
16.....	Totals.....		\$48,200	\$4,702.93	\$325.00

This means that there has been given to the citizens of Elko County road-building equipment of a minimum market value of \$48,200 at a cost to them of less than 10% of such value. In addition to this the department has purchased in carload lots supplemental equipment such as dump bodies and hoists at prices ranging from 10% to 25% under market prices, which have been delivered to Elko County at actual cost, thus effecting a very material saving to the taxpayers of the county. It is also anticipated that we will receive considerable additional equipment from the War Department, of which Elko County will receive its just proportion.

ESMERALDA COUNTY

In Esmeralda County the problems of state highway construction have required special study on account of the fact that this territory is a strictly mining locality, and roads are subject to extremely heavy traffic during boom periods and to practically no travel at all during the recession of such booms. Fortunately the natural characteristics of that portion of the county where the state highway is located are very favorable to road construction, the soil consisting chiefly of disintegrated granite formation, making excellent roads.

Two routes of the State Highway System are located in Esmeralda County—Route No. 3, extending from the Nye county-line, which is practically the city limits of Tonopah, through Goldfield and thence on through via Lida to the Nevada-California state-line near Lida; and Route No. 5, extending from the branch of the Lida road south of Goldfield toward Beatty. Construction on only one project has been undertaken in Esmeralda County to date, being as follows:

Tonopah to Millers Cut-off Road

Project statement covering this project was submitted to the Federal Government on October 28, 1918, being Federal Aid Project No. 11, and provided for the improvement of approximately 9 miles between

the south city limits of Tonopah and what is locally known as Millers cut-off road. At the time this project was submitted the Divide boom had not yet materialized. Improvement was to consist of a graded road 15 feet wide, which, at that time, was thought ample to take care of traffic. The project was placed under contract to Mr. John O'Keefe on April 29, 1919, and almost coincident with the beginning of construction work the Divide boom was on. It immediately became apparent that a width of 15 feet would not take care of traffic to the Divide District. Therefore the project was amended and the width increased to 18 feet.

The construction conditions on this contract have been unfavorable, owing to the fact that the State found it necessary to take over the completion of the contract before it was more than half done.

On the basis of present estimates the total cost of the job will stand as follows:

Federal Government—50%.....	\$22,168.93
Esmeralda County—25%.....	11,084.46
State share—25%.....	11,084.47
Total estimated cost.....	\$44,337.86

The contract was completed on October 23, 1920, and is now open to traffic.

Survey and Reconnaissance of State Highway Locations

Survey has been made of the entire route between the end of the above contract and Goldfield. The present road over this section is a fair desert road, but some portions of it will require improvement, and it is probable that this section will be taken up for improvement just as soon as possible. The road between Goldfield and Beatty is now an excellent road, only requiring the improvement of short sections.

Finances

Department income and expenditures in Esmeralda County from 1917 to date have been as follows:

Tax year	Valuation	REVENUE		
		Levy	State Highway Fund	County-State Highway Fund
1917.....	\$5,674,744.00	7 cents	\$3,972.32	\$3,972.32
1918.....	5,551,586.00	10 cents	5,551.58	5,551.58
1919.....	5,909,063.00	10 cents	5,909.06	5,909.06
			\$15,432.96	\$15,432.96
EXPENDITURES				
Calendar year	Surveys and plans	Maintenance	Construction	Total
1917-1918.....	\$1,385.19	\$1,881.94		\$3,267.13
1919.....	307.45	3,550.20	\$16,962.52	20,820.17
1920.....	41.25	935.93	36,318.41	37,295.59
Total expenditures in Esmeralda County.....				\$61,382.89

EUREKA COUNTY

Eureka County is one of the counties of the State which has a small population and small valuation, together with considerable road mileage. The county is crossed by two routes of the State Highway System — Route No. 1, crossing the north end from the east Lander county-line on the west to the west Elko county-line on the east, a distance of 20 miles, and Route No. 2, crossing near the south end from

the east Lander county-line on the west to the west White Pine county-line on the east, a distance of approximately 56 miles. Construction conditions in this county are parallel with those in Lander County on the west, the county being practically of the same area and population and with topographical conditions almost identical. As an aid to bridge the gaps of the State Highway System across this county it is the intent of the department to advance funds from the authorized state bond issues. This is necessary in order to go ahead with any considerable amount of improvement, as the income from the county is limited and would require accumulation of the income over a period of several years in order to attempt any work of considerable magnitude. Early in 1917 a complete survey of Route No. 1 across the north end of Eureka County was made by this department, and it was the intent at that time to immediately proceed with the improvement of certain portions of this route in order to eliminate the notorious Boulder Flat, across which the then traveled road was located. Owing to difficulties which came up during 1917 and subsequent years, no actual construction work was begun in the county until the present year. Following a complete investigation of the various possibilities of location through the north end of the county, it was determined that the most feasible location was approximately to parallel the Southern Pacific and Western Pacific Railroads from a point known as Shoshone Point through the Dunphy Ranch, crossing the river near this point and swinging north through what is known as Welch's Canyon over the summit into Elko County and thence down into Carlin on the east side of the range. This leaves out the towns of Beowawe and Palisade. This was made necessary because of the utter impossibility of financing the construction of a road through the Palisade Canyon, as the entire floor of that canyon is occupied at the present time by the Western Pacific and Southern Pacific Railroads and the Humboldt River. To cut a roadway on a shelf above either of these railroads through this canyon would cost more money than the State would have available for construction in this county in a great many years. After a very complete investigation, therefore, the location as above designated was determined upon by this department.

The following report of the State Highway Engineer to the Board of Directors was the basis for the adoption of the location:

The following is a recommendation of your State Highway Engineer for the adoption of a certain route between Battle Mountain and Carlin, Nevada, as the route of the state highway between these points:

We have given the matter of the selection of a location for the road in that territory very serious thought and thorough field investigations; and the decision reached as a result of those field investigations is not the opinion of one man—in fact, Mr. West, the former State Highway Engineer, Mr. N. W. McCluskey, a former chief of party, and Mr. J. E. Smith, who had charge of some of the surveys in that vicinity, all concur with me in the selection of the route which is proposed herein.

The State Highway Act specifies that Route 1 of the State Highway System shall pass through the towns of Carlin, Beowawe, and Battle Mountain, and this, too, in spite of the

fact that there is at present no direct road passing through all of these places. Section 24 of the State Highway Act provides that, whenever it shall appear to the State Highway Engineer that any portion of the State Highway System as defined in that Act would be unreasonably expensive in its construction, he is empowered to divert or change said route as in his discretion may seem best. It is provided, too, that the recommendation of the State Highway Engineer shall be approved by your board.

The general topography of the country throughout this entire region is mountainous in character, and particularly is this true of the entire area between the stations of Farrel and Carlin. This mountainous area does not afford at any points satisfactory passes for highway construction except where the region is cut in two by the Humboldt River and by Welch's Canyon—a considerable distance north of that river. West of Farrel the valley of the Humboldt spreads out in a fanlike manner, so that at Battle Mountain this valley is probably six or seven miles wide, extending to the north of the Western Pacific Railroad station of Rennox. Through this fanlike valley of the Humboldt River there is no well-defined drainage channel, and the drainage of the valley in the winter and early spring months is very poor; overflow channels meander all over this section.

Owing to the present very unsatisfactory condition of the roads between Battle Mountain and Carlin, travel probably encounters more difficulties in negotiating that distance than through any other like section of our State Highway System.

The present road, as it is known to the public, first crosses the wide valley of the Humboldt River after leaving Battle Mountain and touches the north foothills of that valley at a point a short distance east of Rennox. It then follows along these hills to the west side of what is known everywhere as Boulder Flat. A distance of 12 miles is necessary to travel in order to cross this flat at this point so as to reach the foothills about 7 or 8 miles northeast of the White House ranch. From this point to Carlin no especially bad soil conditions are encountered, nor heavy grades—but the road has been located through the areas of least resistance to cheapen construction, and many unnecessary miles of travel are required to be made. The road, in fact, makes a very large loop to the north in order to avoid what has heretofore been termed by county officials as "heavy construction."

The two most serious sections of the present road between Battle Mountain and Carlin are the crossing of the valley of the Humboldt River north of Battle Mountain and the Boulder Flat—particularly the latter. I have been advised by people living in that region—and am aware to a small degree from my own observation—that to construct a satisfactory road across the Humboldt Valley north of Battle Mountain would entail the expenditure of a large amount of money for the construction of a high grade which is necessary in order to be above the flood-waters at certain seasons

of the year, and also to provide a roadbed above the ground water-line of this valley. The region is agricultural, and existing ranches have forced the location of this road in such a manner that it meanders through a considerable distance in order to reach the north side of the valley. To obtain an alinement for our road commensurate with the amount of money which we would be required to expend would necessitate the acquisition of new rights of way for almost the entire distance. Drainage structures would be many in number and very expensive to consider. Boulder Flat consists of a very wide and deep deposit of light alkali silt, absolutely unsuited for the foundation of any sort of roadbed. The soil is too light and shifting to be used in embankments for any sort of gravel or rock surface. It is very susceptible to washing by even the smallest amount of running water. At present the road would be considered in any other section of the country as impassable. In the summer it becomes a series of large and deep chuck-holes which often cannot be observed by the driver because they are filled with loose silt which, when hit by the wheels of a machine, acts like so much water. One cannot drive fast enough across this flat to keep out of his own dust. Ruts form in a single season from six to ten inches in depth, and these, too, in spite of the fact that travel has utilized a width of as much as 100 feet. In wet weather there is seemingly no bottom to the road, and automobiles and teams are often mired for hours until help can be secured. A mixture of this silt and water makes a soft, slippery, slimy surface to the road. The distance as given by our own log—and also by the Blue Book—is 62.5 miles between Battle Mountain and Carlin.

It was first determined that the location of any road between Battle Mountain and Carlin should pass through the neck of the canyon at Farrel or the White House ranch. West of that point a suitable location was easy to determine, and east thereof there were three possible locations to be given consideration. Between Battle Mountain and Farrel the determination of the route lay between a location just north of the Southern Pacific Railroad and one just south of that point. The location paralleling the railroad on the south was selected because it passes through a region of more stable soil, freer of low alkali flats, high above the flood-waters of the Humboldt River, and for the most part it is an existing road, and, with but little maintenance, can be made into a satisfactory temporary roadbed. The only change from this which might be considered would be to make a straight line from Battle Mountain to Argenta. This is unsatisfactory for two reasons, the first of which is that we would have to cross a portion of the Humboldt Flat; and, second, because there is some talk of straightening the railroad in about the same manner, which would probably cause future trouble with the company in the matter of its location, particularly in regard to railroad grade-crossings.

East of Farrel on to Carlin there are three possible locations—the first following the canyon of the Humboldt River passing through Beowawe and Palisade; the second over the Beowawe and the old Emigrant Pass road; the third across the Southern and the Western Pacific Railroad tracks and the Humboldt River to the White House ranch and thence in a northeasterly direction paralleling the general direction of Boulder Flat, but high above that valley, and then utilizing for the most part the existing traveled road to Carlin.

By adopting any one of these three possible locations it is necessary to cross at least once both the Southern and the Western Pacific Railroad tracks and the Humboldt River.

The canyon of the Humboldt River in the vicinity of Palisade is narrow and well defined in most places with precipitous walls. The river meanders through this canyon as much as it is possible for a river to do. It seems to strike one side of the canyon and is then diverted to the other side, where it is thrown back as before. This is partially shown on the sketch submitted as a part of this report. Both the Southern Pacific and the Western Pacific Railroads occupy the canyon in addition to the river. The railroads are both required to cross the Humboldt River in a number of places. Tunnels are frequent on both lines, and one crossing with each other is made just west of Palisade. The fact that the many river crossings, tunnels, and a railroad crossing are necessary is sufficient to show that the country is difficult for railroad location.

It would be difficult to thread our location through this canyon which is now so crowded with the river and railroads.

It was estimated by Mr. J. E. Smith, who made a thorough investigation of the country between Beowawe and Barth on October 3, 1917, that it would be necessary to move 50,000 cubic yards of earth, 15,000 cubic yards of solid rock, and 18,000 cubic yards of loose rock. It is my opinion that he has been conservative in his estimate, particularly as regards the classification of the material. I believe there would be a larger amount of solid rock.

It is true that there is some abandoned Southern Pacific Railroad grade in this canyon, but it is in very short sections, and, compared to the whole distance, does not amount to a great deal. This old grade has not been transferred to the State by the railroad company as have practically all other sections throughout the northern part of the State. It is doubtful if satisfactory arrangements can be made with the railroad companies for right of way, not only on this old grade, but across other sections of their congressional grant. It would be necessary throughout practically the whole line to keep within the 400-foot right-of-way grant. The distance from Farrel to Carlin by this route is approximately $37\frac{1}{2}$ miles, of which 12 are of heavy canyon construction.

The second route we have considered is the one passing through Beowawe and the old Emigrant Pass. It has but very little to commend it except that the present road from the

White House ranch to Beowawe is in excellent condition and passes through a stable soil formation. From Beowawe to Carlin the road passes over two ranges of mountains, one of which may be called a pass, but the other seems to be a small summit. This is the route used by the first emigrants in passing through this territory and is now used by no one except the people traveling from Beowawe to Carlin. Twenty-three miles of this road pass through a rolling country, and easy grades with our location would be very hard to obtain. None of this route serves local people except those living in the vicinity of Beowawe, which is the only thing requiring that it be given consideration.

The construction would be heavy, nothing but steep grades could be obtained, and the high elevation necessary to cross the two ranges would cause it to be blockaded by snow for a portion of the year.

The third route to which we have given consideration is one commencing at Farrel and continuing on the south side of the Southern Pacific Railroad to Shoshone Point, which is one-half mile east thereof. It would then be necessary to cross the two railroad tracks and the Humboldt River to the White House, which is the headquarters of the Dunphy Ranch and about ten miles north of Beowawe; thence in a northeasterly direction to the western mouth of Welch's Canyon, a distance of approximately 8 miles. This is an existing road, high above Boulder Flat, but paralleling it on the east. The soil is a gravelly nature and capable, at least temporarily, of sustaining any traffic coming through this region. Almost direct alinement has been secured for this distance of eight miles. The construction is very easy, and the grades will probably not exceed 2%.

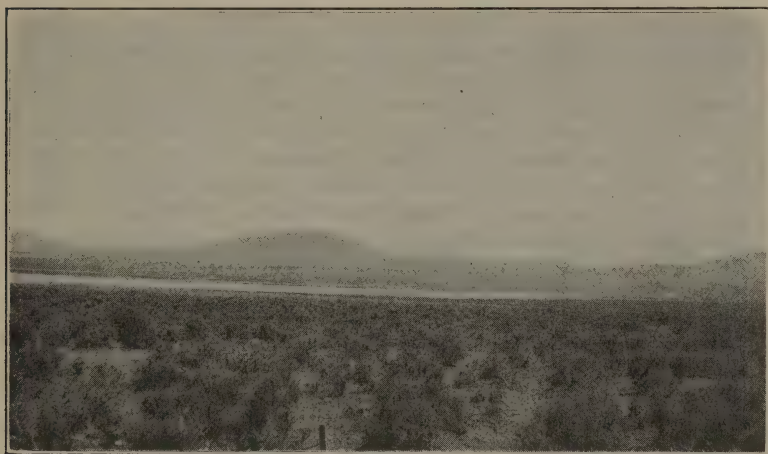
At the west mouth of Welch's Canyon this road junctions with the road crossing Boulder Flat, but the Boulder Flat road at this point goes in a northerly direction, making a large loop to the east end of Welch Canyon. We propose—and, in fact, have made our survey through Welch Canyon—to avoid this unnecessary loop. The distance through Welch Canyon is about 11 miles, and our location has been made so as to avoid grades exceeding 5%.

Some of this construction will be rather heavy, and it will run in the canyon probably as high as 20% solid rock. From the east end of Welch's Canyon to Carlin is the present traveled road offering no unusual difficulties of construction. In fact, a large quantity of suitable shale is available alongside the road for surfacing. The distance from Farrel to Carlin by this route is approximately 32 miles. There is not more than two miles in difference between the Welch Canyon route and the Emigrant Pass location. It appears that there are 23 miles of rolling country by way of the Emigrant Pass route as against 14 miles of rough country through Welch Canyon, the other portion of the Welch Canyon route being almost level and very easy to traverse. It appears that the canyon route would be $37\frac{1}{2}$ miles long as compared to 32 miles

by way of Welch Canyon. The Palisade road would require 12 miles of heavy canyon construction as against 6 miles of light canyon construction through Welch Canyon.

At the time of the location of the transcontinental telephone line a great amount of field investigation was made to determine the location of that line, and thought was given most seriously to snow conditions and the possibility of later constructing a road along that line for maintenance purposes. This transcontinental telephone line passes through Welch Canyon and down Maggie Creek to Carlin, and the decision of the telephone company should be given consideration when making our own location.

The Welch Canyon route traverses a territory now served by no other transportation facility, while the location through



View of flats to be eliminated by Eureka-Hay Ranch Project
in Eureka County

the canyon of the Humboldt River parallels two transcontinental railroad systems.

No detailed estimates of cost have been made as between the locations enumerated above, and they would be of no value except as a comparison. I would roughly estimate that the comparative costs of the different routes would be about in the following proportions: That through Palisade Canyon, 100; that by way of Beowawe and the Emigrant Pass, 75; and that by way of Welch Canyon, 60.

All of the heavy construction of this road is in northern Eureka County, and, on the basis of our scheme of financing the various road projects in this State, there is not now, and probably will not be for a long period of years, a sufficient amount of money in Eureka County fund to bear the proper proportionate share of this cost.

Using the above as a basis, and after your State Highway Engineer has made a thorough field investigation of all these

routes, he has no hesitancy in recommending to your board the adoption as a state highway between Battle Mountain and Carlin of the following route:

Leaving Battle Mountain on the south side of the Southern Pacific Railroad and going east, paralleling that road to Farrel; thence crossing the Southern and Western Pacific Railroads and the Humboldt River to the White House ranch-house; thence in a northeasterly direction to the west mouth of Welch Canyon; thence easterly through Welch Canyon to Maggie Creek; thence along the west side of the valley of Maggie Creek to Carlin, a distance of approximately 60 miles, which is very nearly identical with the railroad between those points.

Aside from the considerations given above, this route has the additional advantage that, when the one mile of road is constructed between Shoshone Point, which is just east of Farrel and the White House ranch, it can be utilized as the main road between Carlin and Battle Mountain; thus, with one short section of construction, eliminating Boulder Flat.

This short section will necessitate the making of a high fill requiring approximately 30,000 cubic yards of excavation and also the construction of a bridge across the Humboldt River at that point. A project statement has been submitted to the Secretary of Agriculture and approved by him for this construction. If the route as outlined above is adopted by your board, it is my purpose to construct this fill and bridge at the earliest possible date. On this same route a project statement has been submitted to and approved by the Secretary of Agriculture for that section between the west Elko county-line and Vivian, a distance of 9 miles. Vivian is the western terminus of the project now under construction in Elko County. Plans, specifications, and estimates are completed for this project.

No right-of-way difficulties are anticipated on this entire route. Considerable right of way will need be acquired from the Dunphy Estate, which has large holdings throughout the entire region. The location has been made in such a manner that all of it is entirely satisfactory to those people. At the time of making our survey we very freely consulted with Mr. Mahoney, the superintendent of the properties.

I trust that the above will be given your early and favorable consideration.

Taking up in detail the projects which are now under way or contemplated in Eureka County, we have the following:

Highway and Bridge at Dunphy—Route No. 1

The project statement was submitted to the Federal Government on March 21, 1919, providing for the improvement of that portion of Route 1 across Eureka County between the west Eureka county-line and the White House ranch, better known as Dunphy, a total length of 6.28 miles.

The improvement was to consist of a 20-foot roadbed, with 9 feet of

gravel surfacing 5 inches in depth, together with a 126-foot steel-truss bridge over the Humboldt River. The total estimated cost of the project, together with apportionments of costs, was as follows:

Federal Government.....	\$54,411.50
Eureka County.....	17,244.07
State share.....	37,167.43
Total estimated cost.....	\$108,823.00

On June 15, 1920, a contract was let to the Missouri Valley Bridge and Iron Company for the furnishing of steel for the bridge portion of the above project. This steel was delivered at the site of the work during September, 1920, and the total cost of this portion of the project with apportionments is as follows, on the basis of present estimates:

Federal Government—50%.....	\$3,994.32
Eureka County—25%.....	1,997.16
State—25%.....	1,997.16
Total estimated cost.....	\$7,988.64

This contract was followed by the letting of a contract for the erection of the bridge to the firm of Jenkins & Wells of Sacramento on July 12. This contract includes the erection of the structure with necessary piling, etc., together with sufficient excavation to make the bridge approaches. The total estimated cost of this job, together with apportionments to participants, is as follows:

Federal Government—50%.....	\$5,928.17
Eureka County—25%.....	2,964.08
State—25%.....	2,964.09
Total estimated cost.....	\$11,856.34

The construction of the bridge is now under way, and should be completed about February, 1921.

The surveys for the remainder of the project are complete, as are also the plans, and the work will be begun just as soon as conditions become favorable.

Eureka-Hay Ranch—Route No. 2

Between the town of Eureka and what is locally known as Hay Ranch, on Route No. 2 across the southern end of the county, is located an extremely bad section of road consisting of approximately 8 miles across an alkali flat. The Lincoln Highway Association has always earnestly desired the improvement of this particular section, it being considered one of the worst sections of road on the transcontinental highway. Pursuant thereto this project was designated as one of those for improvement in the gift of the Lincoln Highway Association to the State of \$120,000, made during the calendar year 1919, and that association set aside for aid in improving this particular section the sum of \$7,500 to be used in conjunction with federal, state, and county aid for necessary construction. Accordingly, on June 14, 1920, a project statement was submitted to the Federal Government for the improvement of this 12.2-mile section, with an 18-foot graded roadway with 10-foot gravel surfacing 5 inches in depth, with turnouts 18 feet wide approximately every 2,000 feet. The total estimated cost of this work, together with apportionments, is as follows:

Federal Government—50%.....	\$43,912.00
State.....	21,956.00
Eureka County.....	21,956.00
Total estimated cost.....	\$87,824.00

The surveys and plans for this project were completed early in 1920, and on September 13, 1920, bids were called for the construction of this section. Only one bid was received, however, and it was so greatly in excess of the estimate that it was decided to reject same and hold up the improvement of this section until the coming season, at which time, no doubt, construction conditions will be much more favorable than during the present year. The Lincoln Highway Association extended the period for the acceptance of their gift on this project to and including 1921, and we therefore hope that this project will be started during the coming year or as soon as weather conditions will permit.

Finances

The total income and expenditures in Eureka County, from date of organization of this department in 1917 to the present time, have been as follows:

<i>Tax year</i>	<i>Valuation</i>	REVENUE		<i>County-State Highway Fund</i>
		<i>Levy</i>	<i>State Highway Fund</i>	
1917.....	\$6,032,659.00	7 cents	\$4,222.40	\$4,222.40
1918.....	6,628,073.00	10 cents	6,628.07	6,628.07
1919.....	6,394,840.00	10 cents	6,394.84	6,394.84
Totals.....			\$17,245.31	\$17,245.31

EXPENDITURES

<i>Calendar year</i>	<i>Surveys and plans</i>	<i>Maintenance</i>	<i>Construction</i>	<i>Total</i>
1917-1918.....	\$2,754.34	\$211.48	.....	\$2,965.82
1919.....	1,404.47	991.08	.....	2,395.55
1920.....	4,612.73	.....	\$11,508.44	16,121.17
Total expenditures in Eureka County.....				\$21,482.54

Surplus War Material Delivered to Eureka County

<i>No.</i>	<i>Equipment</i>	<i>Dept. No.</i>	<i>Market value</i>	<i>Cost to County</i>
1.....	2½-ton Nash Quad truck.....	86	\$2,000	\$271.88
1.....	3½-ton Peerless truck.....	65	4,200	537.12

HUMBOLDT COUNTY

Before the division of Pershing County from Humboldt County, in point of area Humboldt County was next to Elko County. Only one route of the State Highway System is located through Humboldt County, being Route No. 1 along the main line of the Southern Pacific Railroad from the north Pershing county-line to the west Lander county-line on the east, with a total mileage of approximately 60 miles. In 1917 a project statement was submitted to the Government covering the improvement of a 17-mile section of road on this route, being between Lovelock and Zola, which was then located in Humboldt County, together with the construction of a reinforced-concrete bridge over the Humboldt River near Kodak. This was later followed by an additional project for the extension of this same section to a point

3½ miles north of Mill City, this additional extension being approximately 26 miles in length, making the total length of the two projects about 44 miles. Owing to construction difficulties and the attitude of the War Industries Board, together with various other factors, this construction work was not started during the year 1918, and at the 1919 session of the Legislature Humboldt County was divided into Pershing and Humboldt Counties. Both of these projects were included in the area divided off as Pershing County. This meant no projects approved and in line for improvement within Humboldt County as now constituted. Early in 1920 we began the preparation of project statements to submit to the Federal Government covering the road between Golconda and the east county-line, but just about the time they were submitted the question of roadway widths was brought up by the federal authorities and approval was refused on a roadway width of less than 24 feet. This eventually prevented further progress on the construction of any of these sections, despite the fact that the surveys were complete and the plans ready for preparation.

In this matter of roadway width the department is opposed to construction of a roadway greater than 21 feet in width on outlying projects, and in many cases only 18 feet, which carry traffic comparable with that in Humboldt County. The Bureau of Public Roads, however, has been most insistent for a minimum roadway width of 24 feet. This department takes the attitude that a 21-foot roadbed, which provides a 15-foot surface and 3-foot shoulders on each side, is ample for all traffic needs, both now and in the future, on 95% of the State Highway System. The item of this additional 3-foot width to meet the bureau requirements of 24 feet becomes a very serious financial one, and in many cases would prohibit the construction of contemplated projects because of lack of finances, or, if proceeded with, the 24-foot width would so reduce the length of the project as to seriously reduce the benefit to the territory adjacent to the project. The question of this roadway width was first raised by the Bureau of Public Roads during April, 1920, in the case of the plans for one of the projects in Pershing County, and the bureau flatly refused to approve plans for this and similar projects when a roadway width of only 21 feet was provided. This effectually stopped further progress on projects of this sort until the question of roadway widths was threshed out with the Federal Government. The matter was taken to the Chief of the Bureau, and after several months of negotiation, or during September, 1920, the bureau partly receded from its ruling as to minimum width and made a special provision that Nevada in specified cases would be permitted to construct roads of a minimum width of 18 feet for grading and of 10 feet for surfacing. A complete review of this matter appears in the section of this report devoted to the matter of federal aid.

Although we were partially successful in securing a revision of the requirements on this matter of roadway widths, it was too late in the season of 1920 to get construction under way in Humboldt County on contemplated projects. Construction of projects in Humboldt County has, therefore, been deferred until 1921.

Surveys and Reconnaissance of State Highway Locations

Surveys have been made of the sections between Golconda and the east county-line, and plans are now in course of preparation. Location through this section of the county follows the old abandoned Southern Pacific Railroad grade for a major portion of the distance, which will effect a material saving in the construction costs when the contracts are let. Reconnaissance has been made of the balance of the route in Humboldt County, and the locations definitely determined, although the location surveys have not yet been made.

Finances

Income and expenditures, during the life of the department, in Humboldt County as now constituted, have been as follows:

		REVENUE		
<i>Tax year</i>	<i>Valuation</i>	<i>Levy</i>	<i>State Highway Fund</i>	<i>County-State Highway Fund</i>
1919.....	\$17,687,370.00	10 cents	\$17,687.37	\$17,687.37
EXPENDITURES				
<i>Calendar year</i>	<i>Surveys and plans</i>	<i>Maintenance</i>	<i>Construction</i>	<i>Total</i>
1919.....		\$1,083.45	-----	\$1,083.45
1920.....	\$2,539.32	-----	-----	2,539.32
Total expenditures in Humboldt County.....				\$3,622.77

Surplus War Material Delivered to Humboldt County

Under the Act of Congress making provision for the distribution of surplus war material to the state highway departments, there has been given to Humboldt County the following equipment:

<i>No.</i>	<i>Equipment</i>	<i>Dept. No.</i>	<i>Market value</i>	<i>Cost to Humboldt County</i>
1.....	Heavy Aviation truck.....	104	\$4,200.00	\$346.50
1.....	2-ton Nash Quad truck.....	154	4,200.00	222.67
1.....	3½-ton Kelly-Springfield truck.....	168	4,200.00	347.42
1.....	3½-ton Kelly-Springfield truck.....	169	4,200.00	347.42
1.....	3½-ton Kelly-Springfield truck.....	161	4,200.00	350.00
1.....	3½-ton Kelly-Springfield truck.....	164	4,200.00	350.00
6.....	Totals.....		\$25,200.00	\$1,964.01

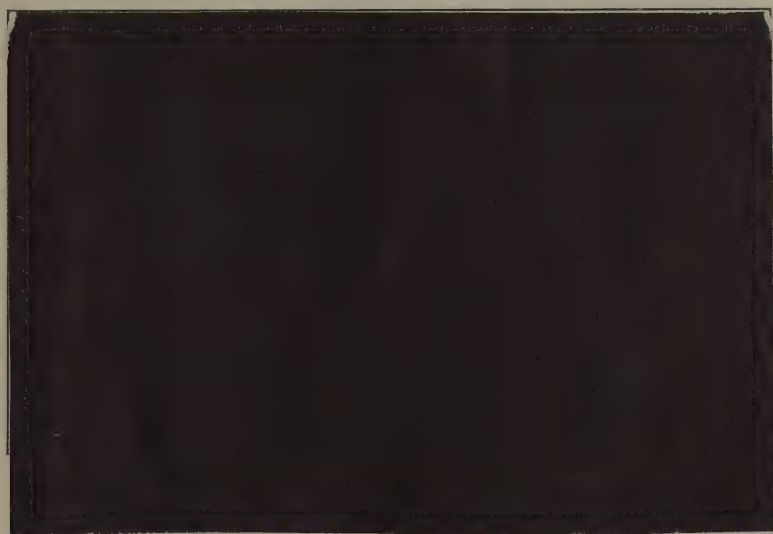
There has also been purchased by the State for Humboldt County additional equipment for the above trucks consisting of dump bodies and hoists which were purchased considerably under the market price, and the advantage of this purchase was given to Humboldt County. In addition, Humboldt County will receive such equipment as it desires from the additional surplus war material which will doubtless be received by this department during the coming year.

LANDER COUNTY

In Lander County we have construction and location difficulties parallel to those of Eureka County, to the east. This county is also included in the group of poorer counties, with limited income due to small population, large area, and a low tax valuation. Two routes of the State Highway System cross this county—Route No. 1, near the north end, through Battle Mountain, and Route No. 2, near the south end, between Churchill County on the west and Eureka County on the east, the first having a length of approximately 25 miles in the county,

and the second about 62 miles. On Route No. 2 there are located two high mountain summits, one, the Austin Summit, having an elevation of about 7,500 feet. This particular summit has always been difficult to travel on account of steep grades and snow blockades during the winter months. This particular summit is located in the National Forest and is the class of road which could be improved under the provisions of section 8 of the Federal Aid Road Act, this section of the Act making provision for the improvement of highways within or adjacent to national forests.

The important question of location between the town of Austin and the west county-line is still up for decision. The travel in the past has always followed the way of New Pass Canyon between Eastgate and Austin, but this department has made some very thorough investigations of some other possible locations between Eastgate and Austin, and has narrowed the possibilities down to the location by



way of Peterson's Pass, Camel Creek, and Carrol Summit, and the present location by way of New Pass Canyon.

Recently a thorough reconnaissance was made of this location in company with officials of the Lincoln Highway Association, which association has agreed to advance the sum of \$42,000 toward aiding in the improvement of this section, and these officials left the final decision as to location to this department, stating, however, that it must be one of the two above-designated routes. This reconnaissance was also made in company with an engineer of the Bureau of Public Roads, and his recommendations concur with those of officials of the Lincoln Highway Association.

The department has now available complete data on the various routes, but the final decision as to location to be adopted has not yet been made.

Taking up in detail the projects which are under way and which are contemplated in Lander County, we have the following:

West Lander County-Line to Battle Mountain—Route No. 1

On December 28, 1919, a project statement was submitted to the Government providing for the improvement of that section of Route 1 located between the town of Battle Mountain and the south Lander county-line, a distance of approximately 9 miles. The preliminary improvement was to consist only of a graded roadway with drainage structures of reinforced concrete. Contract for this work was let to William Licking on April 29, 1919, and the work under the contract was completed in September of the same year. The total cost of the job to the various participants was as follows:

Federal Government.....	\$14,227.40
State share.....	7,825.99
Lander County.....	8,093.43
Total estimated cost.....	\$30,146.82

Further improvement of this section will consist of surfacing with gravel, which will be done in the near future.

sta
thi
Fe
op
the
wo
the
co
wo
sec
wi
be
tha
ma
as completed in 1920, the project of this road section in the State. The cost of this project, as near as can be determined at this time, will be as follows:

Federal Government—50%.....	\$35,000.00
State—25%.....	17,500.00
Lander County—25%.....	17,500.00
Total estimated cost.....	\$70,000.00

Survey and Reconnaissance of State Highway Locations

Surveys have been completed of the remainder of Route No. 1 across the north end of the county, and plans are practically complete for this entire section. In addition, considerable important reconnaissance work has been done on Route No. 2, and it is expected that additional projects will be gotten under way on Route No. 2 during the coming year in order to take advantage of the offer of the Lincoln Highway Association for aid in the improvement of the section between Eastgate and Austin.

Finances

Departmental income and expenditures in Lander County from 1917 to date have been as follows:

<i>Tax year</i>	<i>Valuation</i>	REVENUE		<i>County-State Highway Fund</i>
		<i>Levy</i>	<i>State Highway Fund</i>	
1917.....	\$5,574,179.00	7 cents	\$3,901.93	\$3,901.93
1918.....	6,299,855.00	10 cents	6,299.85	6,299.85
1919.....	6,396,323.00	10 cents	6,396.32	6,396.32
			\$16,598.10	\$16,598.10
EXPENDITURES				
<i>Calendar year</i>	<i>Surveys and plans</i>	<i>Maintenance</i>	<i>Construction</i>	<i>Total</i>
1917-1918.....	\$2,753.60	\$667.66		\$3,421.26
1919.....	1,342.49	132.91	\$30,146.82	31,622.22
1920.....	192.60		30,008.00	30,200.60
Total expenditures in Lander County.....				\$65,244.08

Surplus War Material Delivered to Lander County

<i>No.</i>	<i>Equipment</i>	<i>Dept. No.</i>	<i>Market value</i>	<i>Cost to Lander County</i>
1.....	3-ton Moreland truck.....	72	\$2,000.00	\$99.23
1.....	3-ton Moreland truck.....	74	2,000.00	99.23
1.....	3½-ton Kelly-Springfield truck.....	165	4,200.00	350.00
3.....	Totals.....		\$8,200.00	\$548.46

In addition to the above equipment the county will be given its pro rata of additional equipment, which will doubtless be received from the Army from time to time.

LINCOLN COUNTY

No portion of the State Highway System is located in Lincoln County, and in accordance with the provisions of section 31 of the State Highway Act all revenue from Lincoln County is returned to the county, less the pro rata of administrative overhead of the department.

There has been given to Lincoln County, however, from the surplus war material received from the Government one Peerless truck valued at \$3,600, but which cost the county only \$460.37.

LYON COUNTY

In Lyon County the Highway Department has done a considerable amount of construction work. This county is a large agricultural and mining community, and required first attention in the way of improvement of roads. Early in 1917 a delegation of citizens of Yerington and vicinity made a special request to the department that Route No. 3 of the State Highway System be opened up by way of Wilson Canyon between Smith and Mason Valleys. This would give a connecting link along the West Walker River between these two valleys and mean a saving in distance over the then traveled road of approximately 12 to 15 miles. This construction would follow the Nevada Copper Belt Railroad through the canyon, and it presented many difficulties besides those of financing. Accordingly, a project statement was submitted to the Federal Government providing for the improvement of this canyon section, together with the necessary openings to the existing roads in Smith Valley.

Taking up in order the projects which have been submitted and the work which is now under way and contemplated, we have the following:

Wilson Canyon Section

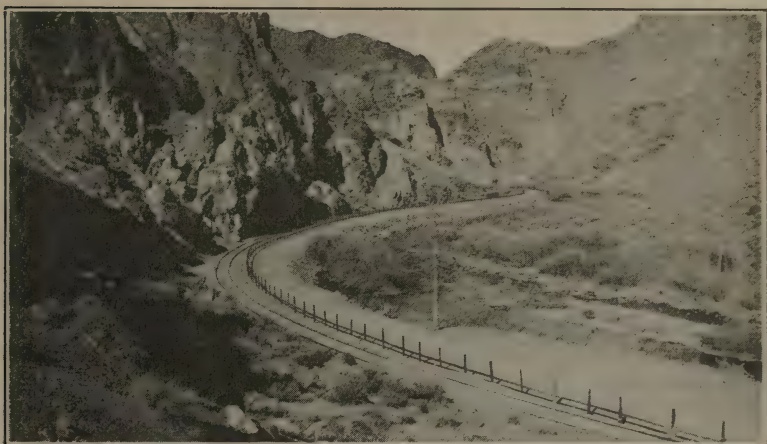
Project statement covering the Wilson Canyon section was submitted to the Federal Government on May 11, 1918. The statement covered a distance of approximately 7 miles, being that portion between the Wilson Ranch, at the Mason Valley end of the canyon, to what is designated the Hudson-Aurora road, which is $2\frac{1}{2}$ miles east of Smith postoffice in Smith Valley. Approximately $2\frac{1}{2}$ miles of this was through the Wilson Canyon proper, consisting of very heavy construction, as well as moving a large amount of the track of the Nevada Copper Belt Railroad to get sufficient room between the railroad and the river for the construction of the highway. It also provided for a concrete-arch bridge over the West Walker River at Bulkhead and the construction of about $4\frac{1}{2}$ miles of graded roadway extending from the bridge on to the end of the project, the Hudson-Aurora road. Contract for the $4\frac{1}{2}$ miles of graded roadway was let to the firm of Niedt & Gavin on January 27, 1919, and this section was completed on August 2, 1919. The cost of this section, which consisted of a graded roadway 21 feet wide, with necessary permanent drainage structures, was as follows:

Federal Government.....	\$11,372.53
Lyon County.....	11,298.80
State share.....	6,955.65
	<hr/> \$29,626.98

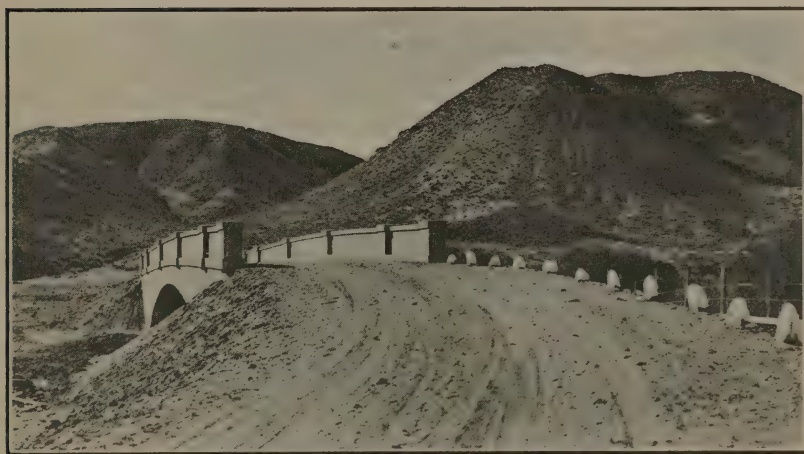
This contract was followed by the contract for the construction of the arch bridge over the river at Bulkhead, which was awarded to the firm of Parrott & Thompson on March 20, 1919. Unfortunately this contract was one of those held by the firm of Parrott & Thompson at the time they went bankrupt, and, owing to this fact, construction of the bridge was very much delayed—in fact, it was finally found necessary to permit the subletting of the contract to another contractor for completion. The work was, therefore, completed by J. L. Hoffmann as contractor on May 22, 1920. The cost of this job, as completed, was as follows:

Federal Government.....	\$5,518.34
Lyon County.....	7,791.07
	<hr/> \$13,309.41

The contract for the canyon section between Wilson's Ranch and Bulkhead was let to the Nevada Construction Company on May 8, 1919. This particular contract included some extremely heavy work, and is one of the largest jobs undertaken by the department to date. The total length of the contract was only about $2\frac{1}{2}$ miles, but a very large percentage of the excavation was of solid rock, and therefore meant a very expensive piece of construction. In addition, we had to shift the tracks of the Nevada Copper Belt Railroad very extensively to permit of the location of the highway between the river and the railroad. The contract called for an 18-foot road, but no surfacing, the natural material being of such nature as to make a surfaced road unnecessary. The highway follows the curves of the river through the



The famous Wilson Canyon Highway in Lyon County. Along this portion the Copper Belt Railroad tracks were moved to allow sufficient room for highway between tracks and Walker River.



Approaching Concrete Arch Bridge, West Walker River, at Bulkhead, Lyon County, Mason and Smith Valley Highway via Wilson Canyon

canyon and is one of the finest scenic sections of state highway construction in the State—in fact, one of the finest scenic roads in the West. The construction of this section was completed in excellent shape, the contract being finished on February 27, 1920.

The final cost of this section was as follows:

Federal Government.....	\$18,016.69
Lyon County.....	26,256.63
State share.....	10,000.00
	<hr/>
	\$54,273.32

West Extension Wilson Canyon Road

The project statement covering the 2½-mile section between the end of the Wilson Canyon project and the existing road near Smith post-office was submitted to the Government on November 15, 1918. The improvement was to consist of a graded road 21 feet, with gravel surface 15 feet wide over the westerly one mile. Contract covering this portion was let to John Ross on June 15, 1920, and at this writing the project is nearing completion.

This extension completes the projected highway through the Walker River Canyon between Mason and Smith Valleys, and the cost of the project, as nearly as can now be determined, is as follows:

Federal Government—50%.....	\$12,804.64
Lyon County.....	6,402.31
State share.....	6,402.33
	<hr/>
	\$25,609.28

South City Limits of Yerington to 6¼ Miles South

This project is also another link in the Mason and Smith Valleys Highway via Wilson Canyon. Project statement was submitted to the Federal Government on December 28, 1918, covering this 6½-mile section, and provided for the improvement of same with a 21-foot roadbed and a 15-foot graveled surface, the surface to be 5 inches thick after compacting, together with permanent concrete drainage structures.

This road follows through the rich agricultural section of Mason Valley, and is an important highway because it permits the ready movement of agricultural products to market. The contract for this section was let to H. Francisco on October 22, 1919, and the contract was completed on June 5, 1920. As it stands today it is an excellent graveled road requiring only nominal maintenance during favorable weather conditions until the surfacing becomes thoroughly compacted, which will probably not be accomplished for another season. The cost, as completed, was as follows:

Federal Government.....	\$23,155.06
Lyon County.....	12,585.61
State share.....	12,585.60
	<hr/>
	\$48,326.27

Wilson's Ranch to South End of Project 17

The project statement, submitted to the Federal Government on June 16, 1920, provided for the improvement of 6.9 miles between the south end of Project 17 and the beginning of the Wilson Canyon project. This project will complete the projected Smith and Mason Valley Highway via Wilson Canyon, giving the county an improved highway for a distance of approximately 24 miles into the heart of Smith Valley. The surveys and plans have been completed on this

section, and practically all necessary rights of way have been secured. It was intended to place this under contract during the past season, but, due to limited finances in Lyon County, this was found impossible. The improvement is to consist of a graded roadway 21 feet wide with 15-foot graveled surface, 5 inches thick after compacting, and is similar to the roadway constructed on the first 6½ miles south of Yerington. The estimated cost of the project, together with the apportionment to the participants, is as follows:

Federal Government—50%.....	\$49,753.00
Lyon County—25%.....	24,876.50
State—25%.....	24,876.50
Total cost.....	\$99,506.00

This project will be taken up and the contract let just as soon as funds become available in the county.

Surveys and Reconnaissance of State Highway Locations

Surveys have also been completed on Route 3 between Smith's postoffice and the Douglas county-line near Wellington. Complete reconnaissance has also been made of location between Yerington and Schurz, and the location to be followed when survey is made has been determined upon.

Finances

The departmental income and expenditures since organization to date in Lyon County have been as follows:

Tax year	Valuation	REVENUE		County-State Highway Fund
		Levy	State Highway Fund	
1917.....	\$7,840,848.00	7 cents	\$5,485.93	\$5,485.93
1918.....	9,784,723.00	10 cents	9,784.72	9,784.72
1919.....	10,331,311.00	10 cents	10,331.31	10,331.31
	Special deposit.....		10,000.00	10,000.00
			\$35,601.96	\$35,601.96
EXPENDITURES				
Calendar year	Surveys and plans	Maintenance	Construction	Total
1917-1918.....	\$3,968.58	\$764.29		\$4,732.87
1919.....	3,489.49	2,530.63	\$71,421.43	77,441.55
1920.....	3,201.84	2,954.37	85,096.54	91,252.75
Total expenditures in Lyon County.....				\$173,427.17

The Legislature of 1919 authorized a bond issue of \$50,000 in Lyon County to aid in the improvement of the State Highway System. To date, however, no bonds have been issued.

Surplus War Equipment Delivered to Lyon County

Under the provisions of the Act of Congress apportioning surplus war equipment to the States, the department has allotted and delivered to Lyon County the following equipment:

No.	Equipment	Dept. No.	Market value	Cost to County
1.....	2½-ton Nash Quad truck.....	137	\$4,200.00	\$266.39
1.....	2½-ton Nash Quad truck.....	156	4,200.00	266.39
1.....	2½-ton Nash Quad truck.....	91	1,800.00	364.00
3.....	Totals.....		\$10,200.00	\$896.78

In addition, the State has acted as purchasing agent for the purchase of additional equipment for these trucks such as bodies and hoists at a

considerable saving to the county. The county will also be allotted additional equipment which will doubtless be received from the War Department.

MINERAL COUNTY

Mineral County has always desired a road along Walker Lake to give an all-year road between the south and the north end of the State and to eliminate the famous Lucky Boy grade which rises to an elevation of about 8,000 feet. To obtain this desire there were two possibilities, one road on the west side of Walker Lake and the other on the east side paralleling the railroad. These both presented enormous construction obstacles—that on the west side on account of extremely rugged country right down to the shore of the lake, and that on the east side because the entire distance consists of shifting sands. However, when the State Highway Act of 1917 was passed, in designating Route 3 of the State Highway System, the Act stated that the location should follow the west side of Walker Lake between Schurz and Hawthorne. One of the earliest investigations made by this department was the feasibility of construction of this section, and it was at once determined that it meant a large financial outlay to construct this road along the west side of Walker Lake. A considerable amount of money was spent in making reconnaissance and location surveys along this shore to determine the most practicable route for construction. These surveys were carried on throughout the year 1918 and a location finally determined upon. It was found that the costs were so excessive that there were no means at that time of meeting same, due to the limited income of the county and of the State from the county. At the 1919 session of the Legislature, however, an Act was passed authorizing Mineral County to issue bonds to the amount of \$30,000 to aid in the construction of this link in the State Highway System. The department therefore presented to the Federal Government on April 21, 1919, project statement providing for the improvement of a 10-mile section of this west-side road, being the section from Cottonwood Creek to a point 10 miles north thereof, taking the construction through the heavy rock portion of the work and up to an existing road on the north. The estimate of construction, as originally submitted, provided for a 15-foot road with maximum gradients of 6%, with necessary permanent drainage structures, and is estimated to cost \$148,060. A contract was let covering this 10-mile section to the Nevada Contracting Company on March 8, 1920, and the contract estimate of cost now stands at \$183,357.90. In addition, the State has just secured federal approval for the extension of the contract for 1.7 miles south from Cottonwood Creek to Dutch Creek, adding an additional \$16,705.15 to the cost. The total estimated cost of the job, as it now stands, then becomes \$202,362.05, to be paid from the following sources:

Federal Government.....	\$101,181.02
Mineral County.....	58,352.57
State share.....	42,828.46

At this writing the progress of the construction on this job is proceeding in excellent shape, and it is expected the contract will be completed in March or April, 1921. When this road is completed it will give to the State of Nevada a very fine scenic highway along the west shores of Walker Lake. The road is benched at an elevation of

and Ely; and Route No. 5 between Cuprite and Charleston Summit at the Clark county-line, a total State Highway System of 281 miles.

In reviewing the work in Nye County we have the following:

Tonopah to West Forest Boundary

On October 4, 1917, a project statement was submitted to the Federal Government providing for the improvement of the section of Route 4 located between Tonopah and the west boundary of the Monitor Division of the Toiyabe National Forest, a total distance of $14\frac{1}{2}$ miles, being Project Statement No. 2. The improvement was to consist of a 15-foot graded roadbed with 9-foot gravel surface, with permanent drainage structures of reinforced concrete.

Contract covering this section was let to the Nevada Construction



Gravel Highway on Route 4 in Nye County. Built under Contract 6, Project 2.

Company on April 10, 1919, and the contract was completed on January 30, 1920. The final cost of the job was as follows:

Federal Government.....	\$24,766.45
Nye County.....	12,383.23
State share.....	12,383.22

Through Monitor National Forest, Section 8 \$49,532.90

Under the provisions of section 8 of the Federal Aid Road Act a request was made to the federal authorities in 1918 for the improvement of a 13-mile section through the Monitor Division of the Toiyabe National Forest between the east end of Federal Aid Project No. 2 and the Stone Cabin road. This project was approved and, after calling for bids, the federal authorities determined to contract same by force account, the State agreeing to bear one-half the cost and the Government to do the work. Accordingly construction on the project was begun early in 1919, and was completed late in that same year. The construction consisted of an 18-foot roadbed with no surfacing. The location is through a low mountain range, and the soil conditions are such that surfacing is not required except over a very small section.

This, together with Project No. 2, gives an improved road for about 27 miles east of Tonopah. The cost of this project is as follows:

Federal Government.....	\$22,516.83
State share.....	\$22,516.83
	<hr/>
	\$45,033.66

Currant Creek Project, Section 8

In addition to the Monitor section we have made application under provisions of section 8 for the improvement of what is known as the Currant Creek project, which provides for the improvement of a 12-mile section through the Nevada National Forest, partly in White Pine and partly in Nye County. Surveys have been completed on this project, and it is thought that the actual construction will be made during the year 1921. No estimates as to total costs of this project are as yet available.

Butler's Ranch to Troy Road

On November 15, 1918, we submitted a project statement to the Government for the improvement of a 25-mile section of Route 4 between Beatty and Troy road, improvement to consist of grading only 15 feet wide, with necessary permanent drainage structures. The surveys have been completed on this section, and the plans are also practically complete, but the construction so far has been held up on account of insufficient finances in Nye County. The original estimate as made up is on the basis of cost of \$40,700. However, because this was made in 1918 an estimate at present would show considerably higher cost. At this writing it cannot be determined just how soon this project will be taken up, but it will be started as soon as finances will permit.

Las Vegas and Tonopah Grade

A major portion of the Las Vegas and Tonopah grade between Beatty and Las Vegas is located in Nye County. On this grade the State has already expended a considerable amount of money, and present plans call for the expenditure of a great deal more in surveying sections which are now in bad condition, due to sand and silty material. A complete review of the activities on this grade is given under Clark County report, and also in the section of this report dealing separately with the Las Vegas and Tonopah grade.

Finances

Large area and small tax valuation have been conducive to a comparatively limited income from Nye County, and the State to date has shared very heavily in construction which has been carried on in this county. Future activities will be gaged to a considerable extent by funds which can be raised by the county itself.

Since organization we have received and expended in Nye County the following:

<i>Tax year</i>	<i>Valuation</i>	<i>REVENUE Levy</i>	<i>State Highway Fund</i>	<i>County-State Highway Fund</i>
1917.....	\$10,753,193.00	7 cents	\$7,527.24	\$7,527.24
1918.....	11,231,474.00	10 cents	11,231.47	11,231.47
1919.....	11,117,039.00	10 cents	11,117.04	11,117.04
			<hr/>	<hr/>
			\$29,875.85	\$29,875.85

EXPENDITURES

<i>Calendar year</i>	<i>Surveys and plans</i>	<i>Maintenance</i>	<i>Construction</i>	<i>Total</i>
1917-1918.....	\$1,532.74	\$1,307.35		\$2,840.09
1919.....	7,486.32	3,833.24	\$33,944.28	45,263.84
1920.....	980.56	18,500.21	36,607.49	56,088.26
Total expenditures in Nye County.....				\$104,192.19

Surplus War Equipment Delivered to Nye County

We have to date allotted to Nye County the following equipment received from the War Department:

<i>No.</i>	<i>Equipment</i>	<i>Dept. No.</i>	<i>Market value</i>	<i>Cost to Nye County</i>
1.....	2-ton Nash Quad truck.....	114	\$4,200.00	\$298.61
1.....	2-ton Nash Quad truck.....	132	4,200.00	298.61
2.....	Totals.....		\$8,400.00	\$597.22

The county will also be allotted its pro rata of additional equipment which will be received from the War Department and the State.

ORMSBY COUNTY

Ormsby County is the smallest county in the State, and also has lowest assessment valuation. The valuation is probably due in a large extent to the fact that the Capitol of the State is located in Carson



Crushing rock in Ormsby County for Carson City-Lakeview section of State Highway.

City in this county, and the major portion of the property in the town belongs to the State, which is, of course, exempt from taxation. In addition, there is a large amount of government property which is exempt in the same manner. This fact makes very difficult the financing of any extensive highway improvement in the county.

Route No. 3 of the State Highway System crosses the county from the north to the south, and extends to the Douglas county-line on the road to Lake Tahoe.

To date only one project statement has been submitted to the Government covering work in Ormsby County. This section is between

Carson City and the county-line at Lakeview, and is part of the Reno-Carson City road. It is contemplated to improve this road with a hard-surfaced pavement consisting of concrete 15 feet wide. The total cost of the job is estimated to be \$125,818.59.

On April 26, 1920, a contract was let to the Pitt-Taylor Syndicate for the grading of a portion of this section extending from the Summit at Lakeview to the property of the Shaffer Estate north of Carson City. This contract was completed in August of the same year.

As this report is written bids are being called for the completion of this project, consisting of the balance of the grading and the laying of the concrete surface. This project, will, therefore, be completed during the coming construction season. The crushed rock for the pavement is available in a stock pile near Carson City, and the necessary sand and cement will be shipped in as needed.

Finances

The department income and expenditures in Ormsby County from 1917 to date have been as follows:

Tax year	Valuation	REVENUE			County-State Highway Fund
		Levy	State Highway Fund		
1917.....	\$1,645,297.00	7 cents	\$1,151.70		\$1,151.70
1918.....	1,750,758.00	10 cents	1,750.76		1,750.76
1919.....	1,746,082.00	10 cents	1,746.08		1,746.08
			\$4,648.54		\$4,648.54
EXPENDITURES					
Calendar year	Surveys and plans	Maintenance	Construction	Total	
1917-1918.....	\$354.38	\$1,814.77	-----	\$2,169.15	
1919.....	716.66	1,076.58	-----	1,793.24	
1920.....	1,014.91	1,533.75	\$21,117.04	23,665.70	
Total expenditures in Ormsby County.....				\$27,628.09	

Surplus War Equipment Delivered to Ormsby County

There has been delivered to Ormsby County and Carson City the following equipment which was received from the War Department:

No.	Equipment	Dept. No.	Mkt. value	Cost to County	Cost to Carson City
1.....	3-ton Moreland truck.....	77	\$1,800	\$99.23	-----
1.....	3-ton Moreland truck.....	80	1,800	99.23	-----
1.....	1½-ton Kelley-Springfield truck.....	180	2,000	-----	\$225.00
3.....	Totals.....		\$5,600	\$198.46	\$225.00

PERSHING COUNTY

Up to March 18, 1919, Pershing County, as now constituted, was a portion of Humboldt County. Pershing County was created by the 1919 session of the Legislature. It so happened that the two projects in Humboldt County which had been undertaken by this department fell within the bounds of Pershing County. Inasmuch as part of the construction work had already been completed, there was necessarily some confusion as to the division of income and expense between Pershing and Humboldt Counties. It has been recognized that one of the worst pieces of road in the State of Nevada is the section between Lovelock and Winnemucca, particularly the section between Lovelock and Rye Patch on Route 1 of the State Highway System. Therefore



Fifteen-foot gravel highway in Pershing County



Eighteen-foot gravel highway in Pershing County.

the first project submitted by this department to the Federal Government called for the improvement of 17 miles of this bad section. This was later followed by an additional project of 26 miles, which, together with the first one, entirely covered the bad-road section on this route.

Taking up the projects in the order in which they have been started in the county we have the following:

Lovelock to Zola

This project statement was submitted to the Federal Government on October 18, 1917, and provided for the improvement of $17\frac{1}{2}$ miles of road located between Lovelock and a point designated as Zola, which is about two miles east of Oreana. Improvement was to consist of a 21-foot graded road with a 15-foot graveled surface for the first three



Completed Gravel Highway in Pershing County

miles east of Lovelock, the balance of the surface to be 10 feet wide, together with a reinforced concrete-pile trestle over the Humboldt River at Kodak. Several attempts were made to start construction during 1918, but no satisfactory bids were received. Finally, however, contract was let on January 27, 1919, for the construction of the bridge over the Humboldt River at Kodak, the contract being awarded to the firm of Parrott & Thompson. This bridge was completed on December 7, 1919, and the final cost of construction was as follows:

Federal Government.....	\$6,540.25
Pershing County.....	3,374.36
State share.....	3,374.30
	<hr/>
	\$13,288.91

On November 18, 1919, a contract was let to P. A. Quigley of Lovelock for the construction of the roadway on this project. This contract was completed on October 2, 1920, and the final construction costs were as follows:

Federal Government.....	\$53,434.21
Pershing County.....	26,717.11
State share.....	26,717.11
	<hr/>
	\$106,868.43

The completion of this project in its entirety marked the first improved graveled road of considerable length which was completed by this department. The road as it now stands is an excellent highway, and is gradually becoming better as it is compacted under traffic.

Zola to Mill City

A project statement was submitted to the Federal Government on January 22, 1919, for the improvement of a 31-mile section of road between Zola, which is the end of the previously mentioned project, and Mill City, paralleling the Southern Pacific Railroad. This project included the bad section of road mentioned heretofore in this report. A contract for this section was let to J. H. Causten and associates of Lovelock on April 20, 1920, the construction to consist of a graded roadway 20 feet wide with surfacing where found necessary, together with the necessary permanent drainage structures. At the date of this report this construction is moving forward and now stands 85% complete. It will be entirely completed early in the coming year. The estimate of costs on basis of contract let stands as follows:

Federal Government—50%.....	\$56,970.03
Pershing County—25%.....	28,485.02
State—25%.....	28,485.02
Total estimated cost.....	\$113,940.07

Surveys and Reconnaissance of State Highway Locations

In addition to the projects as above outlined, surveys have been completed for a considerable distance to the south of Lovelock on the Reno road, as well as a section to the north of the last-mentioned project towards Winnemucca.

Finances

Departmental income and expenditures in Pershing County since January 1, 1919, aggregate as follows:

		REVENUE		
<i>Tax year</i>	<i>Valuation</i>	<i>Levy</i>	<i>State Highway Fund</i>	<i>County-State Highway Fund</i>
1919.....	\$12,498,315.00	10 cents	\$12,498.31	\$12,498.31
From Humboldt County to County-State Highway Fund.....				8,470.00
EXPENDITURES				
<i>Calendar year</i>	<i>Surveys and plans</i>	<i>Maintenance</i>	<i>Construction</i>	<i>Total</i>
1917-1918.....	\$2,521.06			\$2,521.06
1919.....	3,768.36	\$3,382.94	\$24,190.46	31,341.76
1920.....	2,078.20	592.25	152,292.53	154,962.98
Total expenditures in Pershing County.....				\$188,825.80

Surplus War Equipment Delivered to Pershing County

There have been delivered to Pershing County the following trucks and other equipment:

<i>No.</i>	<i>Equipment</i>	<i>Dept. No.</i>	<i>Market value</i>	<i>Cost</i>
1.....	Heavy Aviation 3-ton truck.....	101	\$4,200.00	\$346.50
1.....	2-ton Nash Quad truck.....	153	4,200.00	222.67
2.....	Totals.....		\$8,400.00	\$569.17

STOREY COUNTY

No portion of the State Highway System is located in Storey County, and, in accordance with the provisions of section 31 of the State Highway Act, all revenue from Storey County reverts to the county, less the pro rata of administrative overhead of the department.

There have been given to Storey County from surplus war material received from the Government two Moreland trucks, with a total value of \$5,000 and at a cost to the county of approximately \$430.

WASHOE COUNTY

In Washoe County is situated the city of Reno, the metropolis of the State, and, inasmuch as this is a very wealthy county with the largest population of all the counties in the State, the matter of highway improvement has long had first thought. The State Highway System, as originally laid out by the Legislature of 1917, provides for two routes in Washoe County—Route No. 1, extending from the California line near Verdi to the Churchill county-line at Wadsworth, this route paralleling the Southern Pacific Railroad across the southern end of the county, and Route 3, extending from Reno south to the Ormsby county-line at Lakeview, being the major portion of the Reno-Carson City road. Early attention was given by the department to the matter of improvement of the State Highway System in Washoe County, chiefly because of the fact that this is the traffic center of the State and the roads were in such a condition that they required first attention. Prior to the creation of the State Highway Department this county spent enormous sums of money in maintenance work on its roads, from which there was no visible result, every season requiring a large expenditure year after year. In outlining the program of construction in Washoe County it was thought that the road requiring first attention was the one between Reno and Carson City, and particularly the first few miles south from Reno, which led through a very large agricultural valley. Many difficulties have been met in carrying on the work in Washoe County, particularly the scarcity of local materials, such as gravel and sand, and the acquiring of rights of way in a number of cases. Traffic on the State Highway System in Washoe County is of sufficient volume to justify hard-surfaced highways. Therefore, it was made the policy of the department from the beginning to build nothing but improved hard-surfaced types of pavement, providing same could be financed. That this policy has been a wise one is borne out by the gradually increasing number of hard-surfaced pavements emanating from the city of Reno. It has also been, doubtless, a factor in the forward step taken by the city in paving its city streets, a very large amount of such work having been done during the past season.

In reviewing the work done in the county we have the following:

Huffakers to Washoe Summit

This project was the first one to be taken up for improvement in Washoe County, project statement covering same being sent to the Federal Government on November 22, 1918. The original project was submitted with the intention of surfacing this section with gravel, which action was deemed advisable because of lack of finances to permit of hard-surfaced pavement. Later in 1919, however, funds became

available and the project was amended from graveled surface to a 15-foot concrete pavement. Therefore, the project as it now stands and as approved by the federal authorities provides for $9\frac{1}{2}$ miles of 15-foot concrete pavement 6 inches thick, with necessary concrete drainage structures. Under this project several contracts were let during the seasons of 1919 and 1920, being as follows:

Contract 14—Niedt & Gavin

This contract provided for the grading and structural work between Steamboat Springs and Washoe Summit, with exceptions of short sections through Pleasant Valley. The contract was let on August 27, 1919, and was completed in August, 1920, the total cost being as follows:

Federal Government.....	\$22,109.23
Washoe County.....	11,054.62
State share.....	11,054.62
	<hr/>
	\$44,218.47

This contract was followed by one let to the firm of Armstrong & Baker, designated as Contract 21, which provided for the construction of the section between Huffakers and the beginning of the Niedt & Gavin contract. This contract was completed during July, 1920, and the final costs were as follows:

Federal Government.....	\$15,025.02
Washoe County.....	7,512.51
State share.....	7,512.51
	<hr/>
	\$30,050.04

Contract was then let to J. Woods for the grading and structures on the section near Steamboat, which was completed during October, 1920, with the following cost:

Federal Government.....	\$2,675.40
Washoe County.....	1,337.70
State share.....	1,337.70
	<hr/>
	\$5,350.80

On the 10th day of May, 1920, contract was let to the Pacific States Construction Company for the paving with concrete, together with completion of necessary grading and structure work, of the entire project between Huffakers and Washoe Summit. Under this contract during the season of 1920 the pavement was laid from Huffakers to Brown's Siding, a distance of 2 miles, and from the foot to the top of Washoe hill, a distance of $1\frac{3}{4}$ miles. Owing to the coming on of winter weather it was necessary to close down this contract until the spring of 1921. Construction will be resumed immediately when weather conditions permit in the spring, and the balance of the pavement on this project should be laid early in the summer. The total estimated cost of the entire $9\frac{1}{2}$ miles of this project, on the basis of completed contracts and estimate of uncompleted work, is \$370,453.65.

Reno to Huffakers

On September 30, 1918 a project statement was submitted to the Federal Government for the improvement of the section between Reno and Huffakers, a distance of $5\frac{1}{2}$ miles. This was one of the heaviest traffic roads in the State, and we were successful on May 20, 1919, in

awarding a contract for its construction to the firm of Ward Brothers of Reno, Nevada, improvement to consist of an 18-foot pavement 6 inches thick, with 3-foot graveled shoulders on each side. During the year 1919 approximately three miles of this pavement were laid by the firm of Ward Brothers, or from the city of Reno south to a point approximately half a mile south of the Moffat Ranch. Unfortunately the firm of Ward Brothers went into bankruptcy during the winter of 1919, and when work opened up in the spring it was necessary for the bondsmen to take over this contract. Under the arrangement perfected with the bondsmen the completion of the contract was sublet to the Pacific States Construction Company, who went ahead with the construction, and the balance of the pavement to Huffakers was completed during August of the present year.

There was also constructed over Evans Creek, about $3\frac{1}{2}$ miles south of Reno, a 35-foot reinforced concrete-arch bridge. This was built by



Concrete Arch Bridge on Reno-Huffaker section of Reno-Carson City Highway. Built under Contract 31, Project 9.

the firm of Bishop & Griscom under separate contract. The total cost of completion of the entire project from Reno to Huffakers, on the basis of completed contracts and unpaid portions of contracts, aggregated the sum of \$193,554.53, the total cost being divided on the basis of 50% to the Government and 25% each to Washoe County and the State.

Reno to Sparks

On April 5, 1919, a project statement was submitted to the Government for the paving of the 1-mile section between the cities of Reno and Sparks. Improvement was to consist of a 24-foot concrete pavement, 6 inches thick, with 3-foot graveled shoulders on each side, on a 36-foot graded roadbed. On this project we have traffic conditions paralleling the traffic of a city street, because Sparks is located so near the city of Reno that it is almost a suburb thereof, and traffic during the morning and evening hours is extremely heavy over this road. Prior to the construction of the concrete pavement probably more money was spent for maintenance and repairs on this section than on any ten sections of equal length in Washoe County.



Laying Concrete Pavement, 18 feet wide, under Contract 12, Project 9,
Reno-Carson City Highway.



Steam-Shovel Operations on Contract 147, Project 7, Reno-Carson City
Highway, on the Washoe Hill.

On August 5, 1919, a contract was let to the Pacific States Construction Company for the laying of the pavement on this project, and the construction was completed on November 10, 1919. This section of pavement was the first concrete pavement completed and thrown open to traffic in the State of Nevada. The final cost of the contract was as follows:

Federal Government.....	\$19,400.00
State share.....	27,048.94
	<hr/>
	\$46,448.94

Washoe Summit to Lakeview

On March 8, 1920, a project statement was submitted to the Federal Government for the improvement of a 10½-mile section of Route 3 between the top of Washoe Summit (which is the south end of Project 7) and the Ormsby county-line at Lakeview, improvement to consist of a 15-foot concrete pavement on a 21-foot graded roadbed. This project was approved by the federal authorities and later divided into two sections—Section A being from Washoe Summit to Franktown, and Section B from Franktown to Lakeview. On May 5, 1920, a contract was let to the Pitt-Taylor Syndicate for Section A between Washoe Summit and Franktown. Under this contract construction work was carried on during 1920 and approximately 1¾ miles of pavement were laid, beginning at a point half a mile south of Winters's ranch and extending to a point very close to Washoe Summit. In addition, the grading was completed from the end of the pavement to the top of Washoe Summit and from the south end of the pavement to Bowers Mansion. This contract will be completed as soon as weather conditions will permit in the spring, the approaching winter weather having compelled the closing down of the contract during the fall of the present year. As near as can now be estimated, the final cost of this section will aggregate \$212,304.72, the Federal Government paying 50% of the cost and Washoe County and the State the balance.

On Section B, extending from Franktown to Lakeview, two grading contracts have been let to W. J. Schmidt, which include the grading and structure work for the entire section. A contract will be let for the paving of this section just as soon as possible during the coming season, and this should mean the completion of the project with the pavement by the fall of the year 1921.

The final cost of this section, as near as can now be estimated, will be \$245,061.30.

Reno to Lawton Springs

On October 31, 1919, a project statement was submitted to the Bureau of Public Roads for the 4-mile section between Reno and Lawton Springs on the Reno-Verdi Road, providing for a 15-foot concrete pavement on a 21-foot roadbed, with 3-foot graveled shoulders. Surveys and plans have been completed on this section and have been approved by the Federal Government. Estimate of cost as presented in 1919 showed the total cost as \$153,168.40. A revision of this estimate will be necessary when the work comes up for contract, which will probably mean an increased cost. This project is on the program for improvement in 1921.

Reno-Purdy Road

At the request of the Board of County Commissioners of Washoe County we have submitted a project statement to the Federal Government asking for federal aid on the improvement of 15 miles of the Reno-Purdy road, being the section from the north city limits of Reno to the California line near Purdy. This road is not a part of the State Highway System, but is of the class of roads which can participate in federal aid under the terms of the Federal Aid Road Act. At the request of the Board of County Commissioners this department also made surveys and have gotten out plans for this road, the county bearing the entire cost of such surveys and plans. Definite decision as to type has not yet been made. However, it is thought that it will consist of a 15-foot asphaltic-concrete surface with a 21-foot roadbed, the cost to be borne equally by Washoe County and the Federal Government. This project, it is anticipated, will be completed during the season of 1921.

Finances

The departmental income and expenditures in Washoe County from 1917 to 1920 have been as follows:

<i>Tax year</i>	<i>Valuation</i>	REVENUE		<i>County-State Highway Fund</i>
		<i>Levy</i>	<i>State Highway Fund</i>	
1917.....	\$28,127,216.00	7 cents	\$19,699.05	\$19,699.05
1918.....	32,506,575.00	10 cents	32,506.57	32,506.57
1919.....	32,429,615.00	10 cents	32,429.61	32,429.61
			\$84,635.23	\$84,635.23

In addition, Washoe County was authorized by an Act of the 1919 Legislature to issue county bonds in the amount of \$500,000 to aid in the improvement of the State Highway System in Washoe County, this money to be available for the improvement of the State Highway System as designated, together with the Reno-Purdy road, hereinbefore mentioned. Of these bonds a considerable amount has been sold to carry on work during the past year, and the balance will be sold for the completion of the work in 1921.

EXPENDITURES

<i>Calendar year</i>	<i>Surveys and plans</i>	<i>Maintenance</i>	<i>Construction</i>	<i>Total</i>
1917-1918.....	\$7,600.27	\$3,967.05		\$11,567.32
1919.....	5,920.21	6,885.74	\$85,718.88	98,524.83
1920.....	9,404.47	4,282.76	441,748.00	455,435.23

Total expenditures in Washoe County.....\$565,527.38

Surplus War Material Delivered to Washoe County

We have delivered to Washoe County and the cities of Reno and Sparks from the surplus war equipment received from the Government the following units:

<i>No.</i>	<i>Equipment</i>	<i>Dept. No.</i>	<i>Market value</i>	<i>Cost to County</i>
1.....	2½-ton Moreland truck.....	75	\$1,800	\$99.23
1.....	2½-ton Moreland truck.....	79	1,800	99.23
1.....	Heavy Aviation 3½-ton truck.....	105	4,200	288.20
1.....	Heavy Aviation 3½-ton truck.....	106	4,200	288.20
1.....	2½-ton Nash Quad truck.....	117	4,200	806.25
1.....	2½-ton Nash Quad truck.....	115	4,200	279.66
6.....	Totals.....		\$20,400	\$1,860.77

No.	Equipment	Dept. No.	Market value	Cost to Reno
1.....	1-ton Kelly-Springfield truck.....	191	\$2,000	\$225.00
1.....	1½-ton Kelly-Springfield truck.....	196	2,000	225.00
1.....	2½-ton Moreland truck.....	282	3,200	225.00
1.....	1½-ton Kelly-Springfield truck.....	192	2,000	225.00
1.....	1½-ton Kelly-Springfield truck.....	193	2,000	225.00
1.....	1½-ton Kelly-Springfield truck.....	197	2,000	225.00
1.....	1½-ton Kelly-Springfield truck.....	177	2,000	225.00
1.....	1½-ton Kelly-Springfield truck.....	179	2,000	225.00
1.....	1½-ton Kelly-Springfield truck.....	184	2,000	225.00
9.....	Totals.....		\$19,200	\$2,025.00
No.	Equipment	Dept. No.	Market value	Cost to Sparks
1.....	3½-ton Kelly-Springfield truck.....	163	\$3,600	\$350.00
1.....	2½-ton Packard truck.....	204	2,000	325.00
2.....	Totals.....		\$5,600	\$675.00

Besides the above, 25 sets of artillery harness (market value, \$2,000), were allotted to Washoe County, at a cost of \$200.

WHITE PINE COUNTY

In White Pine County we have a rather unique financial situation from the fact that about 85% of the total taxes of the county are paid by the Nevada Consolidated Copper Company and affiliated concerns, and, inasmuch as taxation of mining companies is based on the net proceeds of mines, it means that the income fluctuates with the market price of mining products. This is graphically illustrated in White Pine County, the valuation in 1918 being \$22,880,000 and dropping down to \$17,524,000 in 1919, directly due to the drop in the copper market. Therefore, in outlining the construction program in White Pine County it has been necessary to take into consideration the probable increase or decrease in valuation of the county. In no other county in the State is this variation so marked as in this particular county.

Portions of two routes of the State Highway System cross White Pine County—Route No. 2 extending from the Utah line near Ibapah down to the city of Ely, thence west and via Illipah to the Eureka county-line; and Route 4 extending from the city of Ely to the White Pine county-line on the road to Tonopah.

Varied road-building problems are presented by these two routes, as the east-and-west route (No. 2) alternately crosses high mountain ranges and wide valleys. At the same time we have in White Pine County one of the heaviest traffic roads in the State—the section between Ely and the mines of Kimberly and Ruth. This road extends down Robinson Canyon parallel with the Nevada Northern Railroad and alternately crosses and recrosses this railroad about eleven times in a distance of 8 miles. Ely being the market center for this wide mining territory, this particular road has always carried heavy traffic, and the same holds true of the road between Ely and McGill, a distance of about 15 miles. McGill is a smelter town, and its trade largely goes to the city of Ely. When mining operations are in full blast at Kimberly and Ruth it is safe to say that jitney travel on the Robinson Canyon road is equal to like travel on the Reno-Sparks road in Washoe County.

Early attention was given to state highway construction in White Pine County, this department feeling that the position of this county



Fifteen-foot Gravel Highway in White Pine County between Keystone and Robinson Summit. Built under Contract 2, Project 6.



Two Dangerous Grade-Crossings over the Tracks of the Nevada Northern Railway between Ely and Keystone were eliminated by this short section of highway. Built under Contract 19, Project 25.

as one of the leaders in mineral production entitled it to first attention. Accordingly, one of the first groups of projects under the Federal Aid Road Act contemplated by this department included one in White Pine County. Taking the projects up in order we have the following to report:

Keystone to Robinson Summit

This project includes a distance of about 12 miles extending from the forks of the road at Keystone in Robinson Canyon up over a new location via Robinson Summit to Jake's Valley. The project contemplated the improvement with a 20-foot graded roadbed and a 9-foot graveled surface. Contract for this section was let to the Lincoln Construction Company on April 10, 1919, and the contract was completed during the year 1920. The final costs of the job are as follows:

Federal Government—50%.....	\$35,100.98
White Pine County—25%.....	17,550.49
State—25%.....	17,550.49
Total estimated cost.....	\$70,201.96

Railroad Grade-Crossing Elimination Near Lane City

In Robinson Canyon on the Ely-Kimberly road there were two particularly dangerous railroad crossings; one of them was at the mouth of a railroad tunnel, and on the other the view was entirely obstructed by projecting mountains on each side. The citizens of White Pine County have always earnestly desired the elimination of these two crossings, but it was an expensive piece of work, and the county could not see its way clear to finance this work. The department submitted a project statement to the Federal Government asking for aid on this short section, and, after approval by the federal authorities, we were successful in negotiating a deal with the Nevada Northern Railroad Company whereby the railroad company agreed to do the work at practically cost by making use of one of their steam shovels. The railroad company was willing to do this because they were continually in fear of a serious accident at either of these crossings, and it was good railroad policy to eliminate them if possible. On the basis of this cooperation we were able to consummate a very expensive piece of construction work at a very reasonable cost. The contract as completed cost the following amount:

Federal Government.....	\$2,652.52
White Pine County.....	2,652.53
	\$5,305.05

Robinson Summit to Illipah (Moorman's Ranch)

On October 28, 1918, a project statement covering this section (a total distance of $16\frac{1}{2}$ miles) was submitted to the Federal Government. Improvement was to consist of a 20-foot roadway with a 9-foot graveled surface over about 10 miles of the distance. This section is a relocation for a large portion of its length, being an extension of Project No. 6, previously mentioned, and bringing it down to the existing road at Illipah. The original estimate of cost of construction on this project was \$94,000. However, should the contract be awarded it will be necessary to revise this estimate, as costs have gone up considerably since the time of preparation in 1918. The surveys and plans are complete for this section.

Surveys and Reconnaissance of State Highway Locations

Surveys have been completed on the remainder of Route 2 in White Pine County, both westward to the Eureka county-line and northward to the Utah state-line. On the section between Illipah and the Eureka county-line a relocation has been made following what is known as the Antelope Summit road which swings northward and eliminates the Hamilton road. On this section the Lincoln Highway Association has donated aid in the sum of \$7,500, and the contract with the association calls for completion during 1921.

Finances

The income and expenditures in White Pine County have been as follows:

		REVENUE			
<i>Tax year</i>	<i>Valuation</i>	<i>Levy</i>	<i>State Highway Fund</i>	<i>County-State Highway Fund</i>	
1917.....	\$28,127,216.00	7 cents	\$19,689.05	\$19,689.05	
1918.....	18,942,778.00	10 cents	18,942.77	18,942.77	
1919.....	17,524,761.00	10 cents	17,524.76	17,524.76	
			\$56,156.58	\$56,156.58	
EXPENDITURES					
<i>Calendar year</i>	<i>Surveys and plans</i>	<i>Maintenance</i>	<i>Construction</i>	<i>Total</i>	
1917-1918.....	\$3,255.14	\$25.88		\$3,281.02	
1919.....	4,123.83	515.17	\$36,412.21	41,051.21	
1920.....	5,217.42	250.00	30,747.06	36,214.48	
Total expenditures in White Pine County.....					\$80,546.71

Surplus War Material Delivered to White Pine County

Surplus war equipment delivered to White Pine County consists of the following:

<i>No.</i>	<i>Equipment</i>	<i>Dept. No.</i>	<i>Market value</i>	<i>Cost to County</i>
1.....	Peerless 3½-ton truck.....	60	\$3,600.00	\$276.22
1.....	Peerless 3½-ton truck.....	61	3,600.00	276.22
1.....	Peerless 3½-ton truck.....	63	3,600.00	544.45
1.....	Peerless 3½-ton truck.....	64	3,600.00	544.45
1.....	Peerless 3½-ton truck.....	66	3,600.00	544.45
1.....	Peerless 3½-ton truck.....	67	3,600.00	544.45
1.....	Peerless 3½-ton truck.....	69	3,600.00	544.45
7.....	Totals.....		\$25,200.00	\$3,274.69

INVENTORY OF PROPERTY

1	Adding machine, Burroughs.	
1	Adding machine, Sundstrand.	
1	Automobile—Buick Touring No. 3.	
1	Automobile—Cadillac Touring No. 1.	
1	Automobile—Ford Roadster No. 5.	
1	Automobile—Ford Touring No. 12.	
1	Automobile—Ford Touring No. 16.	
1	Automobile—Ford Touring No. 17.	
1	Automobile—Ford Roadster, special delivery body, No. 18.	
1	Automobile—Buick Roadster No. 19.	
1	Automobile—Studebaker No. 22.	From War Department
1	Automobile—Studebaker No. 23.	From War Department
1	Automobile—Studebaker No. 24.	From War Department
1	Automobile—Studebaker No. 25.	From War Department
1	Automobile—Ford Touring No. 26.	From War Department
1	Automobile—Ford Touring No. 28.	From War Department
1	Automobile—Ford Touring No. 29.	From War Department
1	Automobile—Ford Touring No. 31.	From War Department
1	Automobile—Ford Touring No. 32.	From War Department
1	Automobile—Ford Touring No. 33.	From War Department
1	Automobile—Ford Touring No. 34.	From War Department
1	Automobile—Ford Touring No. 35.	From War Department
1	Automobile—Ford Touring No. 37.	From War Department
1	Automobile—Ford Touring No. 38.	From War Department
1	Automobile—Ford Ambulance No. 39.	From War Department
1	Automobile—Ford Ambulance No. 40.	From War Department
1	Automobile—Ford Ambulance No. 41.	From War Department
1	Automobile—Ford Ambulance No. 42.	From War Department
1	Automobile—Ford Ambulance No. 43.	From War Department
1	Automobile—Ford Ambulance No. 44.	From War Department
1	Automobile—Ford Ambulance No. 45.	From War Department
1	Automobile—Chevrolet Touring No. 47.	
1	Automobile—Ford Touring No. 48.	
1	Automobile—Ford Touring No. 49.	
1	Automobile—Ford Touring No. 50.	
1	Automobile—Ford Touring No. 52.	
1	Automobile—Ford Touring No. 53.	
1	Automobile—Dodge Touring No. 54.	
1	Automobile—Buick Roadster No. 55.	
1	Automobile—Ford Touring No. 56.	
1	Automobile—Ford Touring No. 57.	
1	Automobile—Ford Touring No. 58.	
1	Automobile—Ford Touring No. 59.	
1	Automobile—Ford Touring No. 310.	
1	Anvil No. 417.	
1	Auger, soil.	
1	Balance, with weights.	
1	Balance, with set weights.	
1	Balance, sensitive weighing.	
4	Barometers, aneroid.	
1	Blue-print machine.	
1	Bookcase (4 sections).	
1	Bookcase (2 sections).	
2	Bookcases (1 section).	
1	Boat (22-foot).	
1	Boat (14-foot).	
235	Boxes of harness.	From War Department
1	Cabinet, map-filing.	
1	Cabinet, form.	
2	Cabinets, filing—Berger.	
1	Cabinet, filing.	
1	Cabinet, wood, map-filing.	

- 1 Cabinet, single-drawer.
- 1 Cabinet, steel, filing.
- 1 Cabinet for ledger cards.
- 1 Cabinet, 4x6, with drawer.
- 1 Cabinet, 4-drawer, steel.
- 3 Cabinets, file, 2 drawers.
- 1 Cabinet, steel, filing.
- 1 Cabinet, filing.
- 1 Cabinet, steel, filing.
- 3 Cases, map-filing.
- 1 Case, card-index.
- 1 Case, steel, transfer.
- 6 Cases, steel, filing.
- 2 Chairs, No. 1051.
- 6 Chairs, folding.
- 3 Chairs, plain arm.
- 5 Chairs, revolving.
- 6 Chairs, typewriter.
- 4 Chairs, office swivel.
- 6 Chairs, office.
- 8 Chairs, No. 55.
- 6 Chairs, No. 707.
- 2 Chairs, plain, oak, No. 1051.
- 2 Checkwriters.
- 1 Chest, map (field use).
- 2 Chutes, unloading.
- 2 Compass, beam.
- 1 Compass, prismatic.
- 17 Compasses.....From War Department
- 1 Curve, railroad.
- 1 Crusher, rock.
- 1 Desk, double, flat-top.
- 1 Desk, flat-top.
- 8 Desks, flat-top.
- 2 Desks, field, small portable.....From War Department
- 1 Desk, bookkeeping.
- 3 Desks, roll-top.
- 1 Desk, steel.
- 6 Desks, typewriter.
- 1 Desk, Ped. T.W. No. 455.
- 1 Dictaphone shaving machine.
- 1 Dictaphone transcribing machine.
- 1 Dictaphone dictating machine.
- 1 Dictaphone machine.
- 3 Drags, road.
- 1 Drag, three-way.
- 2 Drags, Western, two-blade.
- 4 Drawing-boards.
- 1 Drill press.
- 1 Engine, gas, stationary.
- 1 Engine, scraper excavator.
- 1 Emery wheel.
- 3 Files, automatic desk.
- 1 File, auto card.
- 2 Files, card-index.
- 2 Files, tent.
- 2 Forges, Buffalo electric.
- 25 Forges, portable.....From War Department
- 1 Frame, blue-print.
- 1 Gage, depth.
- 1 Grader, Little Western Road.
- 1 Grader, Royal engine.
- 1 Gravel loader.
- 1 Hammer, Little Giant power.
- 1 Harrow.

1	Heater, electric.	
1	Hoist, triplex block chain.....	From War Department
1	Hypsometer.	
1	Iron, electric.	
1	Kettle, asphalt.	
3	Lamps, brascolite.	
7	Lamps, desk, portable.	
1	Lamp, Rayo, kerosene.	
3	Lanterns, Coleman.	
120	Lanterns.....	From War Department
81	Lanterns, folding.....	From War Department
43	Levels, hand—Locke.	
2	Levels—Abney Hand.	
1	Level (Dumpy), and split-leg tripod, Dept. No. 1.	
1	Level (Dumpy), K. & E., Dept. No. 2.....	From War Department
1	Level (Dumpy), K. & E., Dept. No. 3.....	From War Department
1	Level (Dumpy), Y. & S. Dept. No. 4.....	From War Department
1	Level (Dumpy), Y. & S., Dept. No. 5.....	From War Department
1	Level (Dumpy), K. & E., Dept. No. 6.	
1	Level (Dumpy), K. & E., Dept. No. 7.	
1	Level (Dumpy), Berger, Dept. No. 8.	
1	Level (Dumpy), Berger, Dept. No. 9.	
9	Lights—Milburn.	
1	Machine, Fairbanks cement-testing.	
1	Machine, Marchant special.	
1	Machine, Millionaire calculating.	
3	Measures, map, circular.	
1	Motor, 75-hp.	
1	Neostyle, rotary.	
1	Numbering machine.	
6	Planimeters—Amslers.	
1	Planimeter No. 6606, special.	
2	Planimeters, polar.	
3	Planes, road.	
1	Plow, rooter No. 20.	
1	Plow, steel.	
1	Plow, road.	
1	Plow and grader.	
92	Plumb bobs.	
20	Poles, line, steel.	
3	Poles, line, wood.	
2018	Posts, fence.	
1	Pump, Barnes plunger.....	From War Department
2	Pumps, multistage.....	From War Department
25	Pumps, Red Jacket No. 323.....	From War Department
1	Pump, Barnes & Novo engine.....	From War Department
2	Pumps, centrifugal.	
1	Pump, with steel tank and sprinkler.	
1	Pump, gasoline.	
2	Pumps, lubricating.	
1	Rack, book, upright.	
38	Rods, level.	
1	Road roller, Austin.....	From War Department
1	Safe, office.	
1	Saw, hack, power.	
1	Scarifier, H. G. S.	
5	Scrapers, Fresno (4-foot).	
2	Stands, typewriter.	
8	Stools, draftsman.	
2	Stools, high.	
1	Stool, office.	
1	Stove, camp, and grate.	
5	Stoves, camp.	
1	Stove, cook.	

14	Tables, drafting.	
3	Tables, flat-top.	
1	Table, C. T. No. 460.	
1	Table, folding.	From War Department
2	Tanks, steel, knock-down.	From War Department
3	Tanks.	From War Department
10	Tanks, water wagon.	From War Department
1	Tank, water.	
31	Tapes, steel, 50-foot.	
41	Tapes, steel, 100-foot.	
1	Tape, steel, 300-foot.	
1	Threading-machine, bolt.	
2	Tents, 12x14.	
1	Tent, 16x20.	
1	Tent, 12x16.	
2	Tents, 10x12.	
2	Tents, 12x14.	
1	Tent, 8x12.	
7	Tents, 14x16.	
5	Tents (small).	
9	Tools, tape-mending.	
2	Toolboxes.	
1	Torch.	
1	Torch, Cutting "B."	
7	Transits, Gurley.	
8	Transits, Berger.	
1	Transit, K. & E.	
2	Transits, Lietz.	
1	Transit, Beckman.	From War Department
1	Tray rack, No. 42.	
1	Truck-loader, Hercules.	
1	Tractor, Fordson No. 9.	
1	Tractor, Fordson No. 10.	
1	Truck, Ford No. 4.	
1	Truck, Ford, No. 6.	
1	Truck, White, No. 7.	
1	Truck, Ford, No. 8.	
1	Truck, Ford, No. 11.	
1	Tractor, International, No. 301.	From War Department
1	Tractor, Cleveland, No. 302.	From War Department
1	Tractor, Holt Caterpillar, No. 170.	From War Department
1	Tractor, Holt Caterpillar, No. 171.	From War Department
10	Trucks, Peerless, Nos. 60 to 69, inclusive.	From War Department
2	Trucks, International, Nos. 70 and 71.	From War Department
11	Tractors, Moreland, Nos. 72 to 82, inclusive.	From War Department
18	Trucks, Nash, Nos. 83 to 100, inclusive.	From War Department
12	Trucks, Heavy Aviation, Nos. 101 to 112, inclusive.	From War Department
48	Trucks, Nash Quad, New Nos. 133 to 160, inclusive.	From War Department
9	Trucks, Kelly-Springfield, Nos. 161 to 169—3 ton.	From War Department
1	Truck, Packard, No. 172.	From War Department
2	Trucks, G. M. C., Nos. 173 to 174.	From War Department
23	Trucks, Kelly-Springfield, Nos. 175 to 197—1½ ton.	From War Department
2	Trucks, Kelly-Springfield, H. A., Nos. 198 to 199.	From War Department
13	Trucks, Packard, Nos. 200 to 212, inclusive—2½ ton.	From War Department
12	Trucks, Pierce Arrow, Nos. 219 to 230—5 ton.	From War Department
42	Trucks, F. W. D., Nos. 231 to 272, inclusive—3 ton.	From War Department
10	Trucks, Moreland, Nos. 272 to 282, inclusive—2½ ton.	From War Department
7	Typewriters, Underwood.	
1	Typewriter, L. C. Smith.	
1	Typewriter, Royal.	
1	Vise, drill-press.	
1	Vise.	
1	Welding outfit, portable.	
6	Wheelbarrows.	From War Department

INDEX

	PAGE
Allotments Federal Aid Funds.....	10
Allotments Section 8 Funds.....	15
Bridges and Drainage Structures.....	37
Concrete and Gravel-Surfaced Dips.....	37
Standard Plans.....	37
Loading Tests.....	37
Bridge Projects—	
No. 1—Over Humboldt River in Pershing County.....	38
No. 2—Over Canal of Newlands Irrigation Project in Churchill County.....	38
No. 3—Over Carson River in Churchill County.....	38
No. 8-B—Over West Walker River in Lyon County.....	38
No. 9-B—Over Evans Creek in Washoe County.....	38
No. 22—Over Humboldt River in Eureka County.....	39
No. 27—Over Virgin River in Clark County.....	39
No. 35—Over Muddy River in Clark County.....	39
Central Mixing Plant.....	58
Churchill County.....	76
Projects—	
Fallon to Leeteville.....	77
Salt Wells to Sand Springs.....	79
Leeteville to Hazen.....	79
Fallon to a Point Six Miles South.....	80
Frenchman's Flat.....	80
Eastgate to Westgate.....	80
Survey and Reconnaissance.....	80
Finances.....	82
Surplus War Material Received.....	82-83
Clark County.....	83
Projects—	
Virgin River Bridge at Bunkerville.....	84
Muddy River Bridge.....	84
Las Vegas-St. Thomas Road.....	85
Las Vegas and Tonopah Grade Work.....	85
Surveys and Reconnaissance.....	86
Finances.....	86
Surplus War Material Received.....	86
Construction Cost, Comparative Table of.....	17
Construction Progress Map.....	57
Donation of Lincoln Highway Association.....	52
\$120,000 Made Available.....	53
Projects for Which Agreements Have Been Made—	
1. Churchill County—Fallon Sink.....	53
2. Churchill County—Mud Flats.....	53
3. Churchill County—Between Eastgate and Westgate.....	53
4. Eureka County—Between Eureka and Hay Ranch.....	53
5. White Pine County—Antelope Summit.....	54
6. Churchill and Lander Counties—Between Eastgate and Austin.....	54
Actual Cash Receipts.....	54
Time Limits.....	54
Table Showing Projects To Be Constructed.....	55
Donation Proposed by Northern California.....	51
History of Effort.....	51-52
Douglas County.....	88
Projects—	
Carters to Holbrook.....	88
Minden to a Point 3½ Miles North.....	89
Minden to Gardnerville.....	89
Bridges Over Carson River Near Cradlebaugh.....	90
Survey and Reconnaissance.....	90
Finances.....	90
Surplus War Material Received.....	91
Elko County.....	91
Projects—	
Elko to Vivian.....	92
Elko to Halleck.....	93
Vivian to West Elko County-Line.....	94
Surveys and Reconnaissance.....	95
Finances.....	95
Surplus War Material Received.....	96

	PAGE
Equipment Rental Contract Form.....	23
Esmeralda County.....	96
Project—	
Tonopah to Millers Cut-Off Road.....	96
Surveys and Reconnaissance.....	97
Finances.....	97
Eureka County.....	97
Projects—	
Highway and Bridge at Dunphy.....	104
Eureka - Hay Ranch.....	105
Finances.....	106
Surplus War Material Received.....	106
Federal Aid Road Act.....	8
Requirements.....	10-11
Width of Roadway, 24-Foot Requirement.....	11-14
Procedure to Secure Federal Aid.....	15
National Forest Roads—Section 8.....	15
Federal and Privately Owned Land Areas.....	48
Government Equipment.....	19
Section 7 of Postoffice Appropriation Bill of Sixty-fifth Congress.....	19
Kahn Bill.....	20-22
Equipment Received, Description of.....	22
Rental of Equipment.....	22-25
Housing of Equipment.....	25
Equipment Received, Tabulation of.....	26-27
Equipment Received, List of.....	136-139
Humboldt County.....	106
Surveys and Reconnaissance.....	108
Finances.....	108
Surplus War Material Received.....	108
Introduction to Biennial Report.....	7-8
Lahontan Plant.....	41
Purpose of Construction.....	41
Hafed Quarry.....	41
Gravel Supply.....	42
Description of Plant.....	42
Cost of Plant.....	43
Output of Plant, Description of.....	44
Table of Plant Operation.....	74
Table of Plant Output.....	74
Table of Plant Construction.....	74
Lander County.....	108
Projects—	
West Lander County-Line to Battle Mountain.....	110
Austin Summit.....	110
Survey and Reconnaissance.....	110
Finances.....	111
Surplus War Material Received.....	111
Las Vegas and Tonopah Railroad Grade.....	44
Purchase of.....	45
Construction Work, Winter of 1919-1920.....	45
Letter of Transmittal.....	3
Lincoln County.....	111
Surplus War Material Received.....	111
Lincoln Highway—See Donation of.....	52-55
Lyon County.....	111
Projects—	
Wilson Canyon Section.....	112
West Extension Wilson Canyon Road.....	114
South City Limits of Yerington to 6½ Miles South.....	114
Wilson's Ranch to South End of Project 17.....	114
Surveys and Reconnaissance.....	115
Finances.....	115
Surplus War Material Received.....	115
Material, Labor, and High Prices.....	16-19
Maintenance Yard.....	25
Mineral County.....	116
Project—	
Walker Lake Road.....	116
Finances.....	118
Surplus War Material Received.....	118
National Legislation Proposed.....	47
Extension of Federal Aid Road Act.....	48
Townsend Bill.....	48

	PAGE
New State Legislation Proposed.....	48
Licensing of Automobiles and Trucks.....	49
Tax on Gasoline.....	49
Closer Cooperation With Counties Desired.....	49
Condemnation of Property for Rights of Way.....	49
Day-Labor Work.....	50
Nye County.....	118
Projects—	
Tonopah to West Forest Boundary.....	119
Through Monitor National Forest.....	119
Currant Creek.....	120
Butler's Ranch to Troy Road.....	120
Las Vegas and Tonopah Grade.....	120
Finances.....	120
Surplus War Material Received.....	121
Ormsby County.....	121
Project—	
Carson City to Lakeview.....	121
Finances.....	122
Surplus War Material Received.....	122
Overland Trail Club (See Donation Proposed by Northern California).....	51-52
Pershing County.....	122
Projects—	
Loveloek to Zola.....	124
Zola to Mill City.....	125
Surveys and Reconnaissance.....	125
Finances.....	125
Surplus War Material Received.....	125
Personnel of Department of Highways.....	5
Plans (See Surveys and Plans).....	31-35
Private and Federal-Owned Lands.....	48
Property of State Highway Department, Listed.....	136-139
Reno Plant.....	25
Description of.....	25-28
Tabulation of Plant and Yard Operations.....	72
Construction and Profit-and-Loss Accounts.....	73
Report of Department of Highways.....	7
Road Conditions, State Highway System, Map Showing.....	9
Storey County.....	126
Surplus War Material Received.....	126
Surveys and Plans.....	31
Classes of Surveys—	
1. Selection.....	31
2. Reconnaissance.....	32
3. Location.....	32
Plans, Specifications, and Estimates.....	33
Table Showing Cost per Mile of Surveys and Plans, 1917-1920.....	34-35
Survey Progress Map.....	36
Tables—Federal Aid Allotments.....	10
Section 8 Allotments.....	15
Increase in Price of Concrete Road Construction in Cook County, Ill.....	17
Table of Equipment Received from the War Department.....	26-27
Table Showing Cost per Mile of Surveys and Plans, 1917 to 1920.....	34-35
Table Showing Projects To Be Constructed with Aid of Lincoln Highway Donations.....	55
Federal Aid Projects.....	63
Statement of Receipts.....	64
Statement of Disbursements.....	65
Federal Aid Allotments to Nevada.....	66
Projected and Completed Construction by Project Statements.....	66-67
State Contingent Liability on Uncompleted Contracts.....	68
Construction Reimbursements and Amounts Due State.....	69
Classified Construction Expenditures, 1919-1920.....	70
Segregation of Maintenance Expenditures.....	71
Reno Plant and Yard Operations.....	72
Construction and Profit-and-Loss Accounts, Reno Plant.....	73
Lahontan Plant Operation.....	74
Lahontan Plant Output.....	74
Lahontan Plant Construction.....	74
Income and Expenditures, County-State Highway Funds.....	75
War Materials (See Government Equipment).....	19-27, 136-139
Washoe County.....	126
Projects—	
Huffakers to Washoe Summit.....	126
Reno to Huffakers.....	127
Reno to Sparks.....	127

	PAGE
Washoe County Projects (<i>Continued</i>)—	
Washoe Summit to Lakeview.....	130
Reno to Lawton Springs.....	130
Reno-Purdy Road.....	131
Finances	131
Surplus War Material Received.....	131
White Pine County.....	132
Projects—	
Keystone to Robinson Summit.....	134
Railroad Grade-Crossing Elimination.....	134
Robinson Summit to Illipah.....	134
Survey and Reconnaissance.....	135
Finances	135
Surplus War Material Received.....	135

MAPS AND CHARTS

Travelable Conditions of State Highway System of Nevada.....	9
Increase in Price of Concrete Road Construction in Cook County, Ill.....	17
Survey Progress Map of State Highway System of Nevada.....	36
Relation between Federal-Owned Nontaxable Areas and Privately Owned Taxable Lands.....	48
State Highways Completed or Under Contract—State Highway System of Nevada.....	57

ILLUSTRATIONS

Reinforced Concrete Arch Bridge over West Walker River, Lyon County.....	6
Fifteen-foot Gravel Road in Pershing County.....	19
Portion of Machine-Shop Building, Storage-Shed No. 1, and Office and Stockroom Building at Reno Plant.....	29
F. W. D. Truck Received from the Government.....	30
Machine-Shop and Office Buildings, Reno Plant.....	30
Reinforced Concrete Pile Trestle over Carson River, near Fallon.....	40
Reinforced Concrete Pile Trestle near Lovelock.....	40
View of Lahontan Sand-and-Gravel Plant.....	43
Las Vegas and Tonopah Grade after Removal of Steel Rails.....	46
Widening of the Las Vegas and Tonopah Grade.....	46
Portion of State Highway through Wilson Canyon in Lyon County.....	50
Installing Armeo Culverts on Old Railroad Grade between Reno and Lovelock by Overland Trail Club.....	52
Freighting Outfit Crossing the Eight-Mile Flat, Fallon Sink.....	56
Dragline Excavator Making Fill Across Fallon Sink.....	56
Central Mixing Plant.....	58-62
Reinforced Concrete Girder Bridge over Truckee-Carson Canal near Fallon.....	81
Prepared Subgrade Ready for Receiving Gravel Surface on Fallon-Leeteville Highway.....	81
Type of Wooden Trestles on Las Vegas and Tonopah Grade.....	87
Widening Las Vegas and Tonopah Grade in Clark County.....	87
Concrete Highway through the Town of Gardnerville—Douglas County.....	88
Molen Hill on State Highway under Construction, Elko County.....	93
Flats To Be Eliminated by Eureka-Hay Ranch Project, Eureka County.....	103
Typical Desert Road near Battle Mountain, Lander County.....	109
Wilson Canyon Road in Lyon County.....	113
Concrete Arch Bridge in Lyon County.....	113
Walker Lake Road (three views).....	117
Gravel Highway in Nye County.....	119
Crushing Rock in Ormsby County.....	121
Gravel Highway, 15-foot, in Pershing County.....	123
Gravel Highway, 18-foot, in Pershing County.....	123
Complete Gravel Highway in Pershing County.....	124
Concrete Arch Bridge in Washoe County.....	128
Laying Concrete Pavement on Reno-Carson City Highway.....	129
Steam-Shovel Operations on Washoe Hill-Reno-Carson City Highway.....	129
Fifteen-foot Gravel Highway in White Pine County.....	133
Two Dangerous Grade-Crossings Eliminated between Ely and Keystone in White Pine County	133

